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Studies on the Freshwater Fishes of Japan
I. General Part

YAICHIRO OKADA

(XII Plates and 28 figures)

Faculty of Fisheries, Prefectural University of Mie, Japan

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1 Introduction and Acknowledgments

The freshwater fish fauna is rather rich in Japan. Many Japanese ichthyologists have made researches in freshwater fishes and published lots of reports up to the presents. Most of them have usually been printed into short notes but the contributions have never been published. Since 1936, the writer had worked at this problem and nearly completed the manuscripts ready to publish during the war, but unfortunately they were destroyed by fire. After the war, the writer has worked his way with the manuscripts now to get them ready to publish.

The natural conditions of freshwater in Japan are influenced by various environments. There are many types of lakes, swamps, ponds and rivers which are located in different localities of all Japan. Some of the lakes are located in high mountains and others in plains. Some of these rivers are running along very steep slopes in mountain regions while others are flowing very slowly in the plain. Under these different natural conditions, the writer has found freshwater fishes very rich, composed of 27 families and 76 genera including 127 species. Most of them are related to the elements of Asiatic continent, especially the species of family Cyprinoid, Siluroid and Cobitoid fishes which are considered to be derived from elements of the Asiatic continent. The endemic species are found mostly in Lake Biwa and its tributaries, but some of Gasteroid fishes are confined to peculiar localities. It is worthy to note that many foreign species have been introduced from China and United States and now established in Japan. Most of Salmonoid fishes introduced from the United States *Salmo irideus*, *Salvelinus fontinalis* are well established and can be seen in every trout culture pond at different localities in Japan.

Acknowledgements: In the preparation of this monograph the author has been greatly aided by the hearty cooperation and assistance in fields and institutions, particularly the Fisheries Experiment Station of Shiga Prefecture at Hikone, with variable informations supplied.

The author's friends at various universities and institutions have helped him in securing every available specimen during the progress of this investigations.

Here I would like to acknowledge with great gratitude the help of many friends who have sent me living and preserved specimens of fishes, collected at different localities and also appreciate the fisheries experimental stations of all prefectures of Japan for supplying many specimens and for their helps in the collection.

I am very greatful to Dr. CARL L. HUBBS, a curator of the Michigan University Museum then, for having me a great help of the study of freshwater fishes while I stayed there from 1929 to 1930.

I am also appreciate Prof. L. F. DE BEAUFORT at Amersfoort, Netherland who allow me to read the BLEEKER's original papers in his library.

The Paris Natural History Museum is an important depository for Japanese fishes obtained by SAUVAGE from Japan. Through the courtesy of Dr. JAQUES, PELLEGRIN, the writer was able to examine the type specimen.

The Berlin Museum of Natural History has courteously made me available for the study of the type-specimens of Japanese freshwater fishes, and the writer is quite indebted to Dr. ARNDT, curator of the museum.

I am also greatful to Prof. KEITARO UCHIDA of the Fisheries Department of the Kyushu University for his permission to reproduce some of his drawings of the early developments of some species.

I am also indebted to Dr. MASUZO UENO, the director of the Otsu Freshwater Research Station attached to the Kyoto University, where a very extensive collection of freshwater fishes are kept gathered from various localities of Japan.

I must make special acknowledgements for Mr. JIRO KIKKAWA, Department of Zoology of the University of Otago, Duneden, New Zealand and and Mr. TERUYA UENO, Zoological University Museum, Michigan University, U. S. A. in regard to have kindly made me the copies of original descriptions of some species from England and United States, which could hardly be got in Japan.

I am thankful to Mr. GEORGE A. PETERSON, an American civilian at Tokyo and Mr. HIDEO OHTA who have read over this manuscript.

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2 Ichthyological literatures concerned with the freshwater fishes of Japan

In 1709 the ichthyological studies of freshwater fishes of Japan was set to. From the beginning (1709) to the end of 1890, the Japanese scholars called "Honzô-gakusha", naturalists, mostly made records of the freshwater fishes, but not systematically. The foreign researcher LINNAEUS and other ancient biologists made researches in Japanese freshwater fishes together with marine fishes.

The first publication of Japanese freshwater fishes by ATSUNOBU KAIBARA, a Japanese famous scholar, was issued in 1709. In that report, he described about 28 species of common freshwater fishes of Japan.

The first reference to Japanese freshwater fish of the ichthyological publications by foreigners seem to be in the paper by C. LINNAEUS, in 1758, for a single species, *Carassius auratus*.

From 1900 up to 1915, the Japanese freshwater fishes were studied by Dr. D. S. JORDAN and his disciples and followers, the most active ichthyologists, in America, who should have been interested in the fish fauna of Japan and made many noteworthy contributions thereon. Those ichthyologists visited Japan and made a large collection which now preserved in the Stanford, California, and the Michigan University Museum, Michigan, of U. S. A. In this period the Japanese ichthyologists who contributed to the knowledge of Japanese freshwater fishes are Dr. CHIYOMATSU ISHIKAWA, Dr. SHIGEO TANAKA and others. Of these publications, "The Figures and Descriptions of fishes" published by Dr. SH. TANAKA is the most useful for fish researchers. This series is still continued to the present.

In 1903, "The Catalogue of fishes of Japan" was published by Dr. D. S. JORDAN, SHIGEO TANAKA and OTTO SNYDER who have made a nearly complete list of fishes of Japan. In this period, the general classification of the fish is nearly completed by foreign ichthyologists.

From 1915 up to the present, many Japanese proper ichthyologists made researches in freshwater fishes of Japan from different points of view, not only from taxonomy but also from morphology, ecology and physiology.

Here the author makes a short note of a considerable literature pertaining to freshwater fishes of Japan accumulated to note for more than 230 years.

From the data, the author acknowledges to divide the periods of studies of freshwater fishes of Japan into third stage. The first stage (1700～1890) has the characteristic of the unscientific data which were made by the Japanese biologists and foreign ichthyologists.

The second stage (1900～1915) is characterized with the systematic works which were mostly completed by the foreign ichthyologists.

The third stage (1916～) the last one up to the present time, indicates the various fields of studies from the ecological, morphological, physiological and hereditical points of view.

1709

KAIBARA, ATSUNOBU, 1709 (Hôei 6 Nen): Yamato-Honzô, vols. 1–16, appendix vols. 1–2. vol. 1, pp. 1–35; vol. 2, pp. 1–45; vol. 3, pp. 1–36; vol. 4, pp. 1–24; vol. 5, pp. 1–38; vol. 6, pp. 1–40; vol. 7, pp. 1–32; vol. 8, pp. 1–44; vol. 9, pp. 1–42; vol. 10, pp. 1–31; vol. 11, pp. 1–30; vol. 12, pp. 1–48; vol. 13, pp. 1–49; vol. 14, pp. 1–48 ; vol. 15, pp. 1–32; vol. 16, pp. 1–17: appnedix pp. 1–20. (in Japanese).

The author of this book "Yamato-Honzô", KAIBARA ATSUNOBU, was a very famous scholar of Japan during the eighteenth century. He published 16 volumes on Japanese animals and plants and minerals as well as the natural resources. As for the freshwater ones, he describes 30 species in the 13th volume, some of which are supplied with figures. The main species are as follows.

1. *Cyprinus carpio*: It is said that this is the most important and delicious fish among of all marine and freshwater fishes of Japan. It seems to be a king of fish. The scales are 36 on lateral lines.

2. *Carassius auratus*: This fish takes mud of the bottom containing many kind of organisms. The specimen that is found in Ômi, is the very delicious, and we call it specially as "Ômibuna". It has a rather broad body.

3. *Acheilognathus moriokae*: This fish, provided with red patterns, is called "Shinona" at Tsukushi, Kyushû, and "Nigabuna" in the Kantô district (around recent Tôkyô).

4. *Oncorhynchus keta*: This is found in the larger rivers of the northeast districts of Honshû, but not in south.

5. *Oncorhynchus rhodurus*: This is abundant in Lake Biwa, and looks like *Oncorhynchus keta.* It is called "Amenouwo" in Japanese.

6. *Plecoglossus altivelis*: The young of this fish are born in estuary and then ascend river. During summer, they grew gradually. After August, they are going to breed towards autumn. Towards the end of autumn, they descend from the upper river and spawn around in the mouth of river and then die. Those which live in sandy rivers, are slender, while in the large rivers with large stones at the bottom, they grow rapidly as they feed on weeds attached to stones. The specimen which is found in the Asami, Tachiishi-mura, Hayami-gun, Bungo Province, always passes the winter without descending the river, as a hot spring near the river makes the water warm. They differ in many features to the sex. In the female, the head is small and the body somewhat broad and yellow. In the male, the head is small and the body narrow and somewhat darker than the female. The taste of the former is rather inferior to the latter.

7. *Zacco temmincki* (with a figure): This fish is found in every river. There are two different races to their colors in white and red.

8. *Zacco platypus* (with a figure): It lives in the current water of mountain regions. It looks like *Zacco temmincki,* in red and white, and with a black margined mouth. Around the mouth, there are many black pearl organs.

9. *Gnathopogon elongatus elongatus* (with a figure): It looks like *Zacco,* with a small head and a somewhat broad belly.

10. *Pseudogobio esocinus*: This fish resembles *Gobius.* In Kyôto, only those from the Kamo are called "Kamatsuka". They are not swimming under the surface of the water, but towards the bottom.

11. *Cottus japonicus*: The author distinguished two species of this group. One has a round fin on the belly by which the fish sucks stones. The other may be *Tridentiger obscurus,* black and white on the back.

12. *Hemibarbus barbus,*: It looks like a carp. Two different colors, blue and white, exist. They are abundant in Lake Biwa.

13. *Hymenophysa curta*: This fish has barbels around the mouth as *Misgurnus anguillicaudatus.* It is very famous in the Katsura, Sanshû and the Ôi River, Saga (near Kyôto). The largest one attains 30 cm. in body length. The body and caudal fin look like those of *Plecoglossus altivelis,* but the head resembles that of *Misgurnus anguillicaudatus.*

14. *Misgurnus anguillicaudatus*: This fish is small. The author included *Cobitis taenia striata* found in Kyoto in this group. *Lefua echigonia* is also found in canals and streams in Kyôto and Tsukushi (Kyûshû).

15. *Pelteobagrus nudiceps*: They are found in the streams and current waters of mountain region. The spines of pectoral and dorsal fins sting the human body. The author's description of the red one from Saga, Sansyu, may be identified with *Liobagrus reini*.

16. *Opsariichthys uncirostris*: This is found in Lake Biwa. The body attains 28 cm. in length and has white small scales. During summer, they are swimming in groups and sometimes jump up from the water. In April and May, they come up from the bottom ascend the streams and canals around Lake Biwa. At that time, the fisherman angles them with earthworm and shrimp as baits.

17. *Ischikauia steenackeri*; This fish is abundant in Lake Biwa. It resembles *Opsariichthys uncirostris* in size and taste.

18. *Chaenogobius isaza*: This is a small fish, and looks like *Gobius*. In spring, they ascend along rivers, the shallow waters. They are abundant at Wani, Ômi and Tsuruga, Echizen.

19. *Salangichthys microdon*: The common name is "Silver fish", pure white silverly. They are found in Ôsaka and Ise. During winter, they are found in the sea.

20. *Tribolodon hakuensis*: This is found in Lake Hakone, Lake Suwa and in Lake Biwa. In March and April, they ascend rivers from lakes and at that time fishermen catch them in net.

21. *Coreoperca kawamebari*: This is called "Kawamebaru" or "Mizukuri". They are living in the rivers of mountain regions and in some ponds. They attain 6-9 cm. in body length and somewhat flat by lateral.

22. *Oncorhynchus masou*: In old time, this fish was usually offered to the Emperor every year. In the region of KEIKÔ Emperor (71–130, KEIKÔ Age) the fishermen caught at Nagahama, Udogun, Tsukushi Province and presented them to KEIKO Emperor. Also in the region of SHÔMU, it was presented to SHÔMU Emperor from Dazaifu, (742–748). They are abundant in the Chitose, Chikushi (Kyûshû). The smaller ones called "Enoha", look like *Oncorhynchus masou*, and are found in mountain rivers in spring. This may be a smaller form of the present species.

23. *Mugil cephalus*: This is different from *Mugil shikuchi* of round body, with light red.

24. *Anguilla japonica*: The superior and delicious fish of all is found in the freshwater. This fish is quite nutritious and used for medicine. The fish found in Hyûga Province, is very large, about ten times of the others, measuring 30 cm. round and 18 cm. in length. This may be considered *Anguilla mauritiana*.

25. *Hypomesus olidus* (with a figure): This is found in rivers and seas. The body measures 15–18 cm. in length and shows white in color. This is distributed in Edo (Tôkyô), Lake Mikata, Zyakusyû, but not in the western parts of Honshû.

26. *Aplocheilus latipes*: They measure about 3 cm. or less in length and have larger eyes and head. They are always swimming on the water surface of ponds and canals.

27. *Carassius auratus* (Gold-fish): In old times, this did not exist in Japan, and perhaps was introduced from other districts during the Genwa Age (about 1616–1623).

28. *Parasilurus asotus*: It is not distributed in the east of Hakone.

The other several freshwater fishes are described in this volume but they seemed to be difficult to be identified scientifically.

1719

KANDA, GENSEN, 1719 (Kyôhô 4 Nen): Nittô-Gyofu, vols. 1–5, pp. 1–33 (1–26), figs. 1–41. (in Japanese).

The author mentioned 36 species of freshwater fishes. In the 1st volume, the following species are treated of the outer features and their habits. *Cyprinus carpio*, *Carassius*, (including *C. auratus cuvieri*), *Salvelinus*, *pluvius*, *Ischikauia steenackeri*, *Oncorhynchus rhodurus*, *Salvelinus leucomaenis* (Biwa Lake), *Oncorhynchus keta* (Nuno River, Bushû), *Hemibarbus barbus*, *Tribolodon hakonensis*, *Lateolabrax japonicus*, *Abbotina rivularis*, *Acheilognathus tabira*, (Takata River, Bushû), *Acheilongnathus moriokae*, *Opsariichthys uncirostris* (Biwa Lake) ,*Plecoglossus altivelis* (Tamashima River, Hizen), *Mugil cephalus*, *Oncorhynchus masou*, *Hypomesus olidus* (Kasumigaura), *Gnathopogon elongatus caerulescens* (Biwa Lake), *Zacco platypus*, *Odontobius obscura*, *Chaenogobius isaza* (Biwa Lake), *Zacco temmincki*, *Aplocheilus latipes*, *Hymenophysa curta* (Ôi River,

Washû), *Pseudogobio esocinus*, *Coreoperca kawamebari*, *Carassius auratus* (Gold-fish). In the second volume, of the following species are also described the characters of outer feature and habits. The species are *Salangichthys microdon*, *Leucopsarion petersi*, *Anguilla japonica*, *Lampetra japonica* (Echigo) with its albino, *Pseudobagrus aurantiacus*, *Pelteobagrus nudiceps*, *Parasilurus asotus* (Biwa Lake), *Cottus kazika*, *Misgurnus anguillicaudatus*, *Cobitis taenia striata*.

1754

HIRASE, TESSAI, 1754 (Hôreki 4 Nen): Nihon Sankai Meibutsu Zue 5. (in Japanese).

The author illustrates and describes many famous productions of land and sea. From the descriptions, here we mentions, a *Plecoglossus altivelis* which is spawned in August. The next, "Yodogoi" is produced in the River Yodo, Yamashiro Province. The eel is produced in Seta, Shiga Province.

1758

LINNAEUS, CARL, von. 1758: Systema Naturae 10 Afl. Stockholm, pp. 230-338.

This was the first to study the Japanese Cyprinid by foreign biologist. In his tenth edition of Systema naturae he described *Cyprinus auratus* = *Carassius auratus*.

1782

HOUTTYUN, M., 1782: Beschreyvning van eenige Japanishe Visschen, en andere Zeeschepselen; door M. HOUTTYUN, in Verhandelingen, intgegeven door de Hottandsche Maatsschappij der Weetenschappen te Haarlem, xx Deels, 2 Stuk, 1782, pp. 311-346.

The contents of the present report were translated into English by Mr. LEO G. D. MÜLLER and published in the book by D. S. JORDAN in 1901. Here we announce only the chief fact concerned to freshwater fishes. In his report, he indicate that *Gasterosteus japonicus* by STEINDACHER may have changed into *Pygosteus steindachneri*, because *Gasterosteus japonicus* by HOUTTUYN is confirmed to be identified with *Monocentris japonicus*. He also mentions that *Cobitis japonica* may be identified with *Saurida argyrophanes* or some other species and he wishes to change the name of *Cobitis japonica* into *Cobitis biwae*.

1785

BLOCA, M. E., 1785-95: Naturgeschichte der auslandischen Fishes. 3dde Berlin.

The author described *Cyprinus maclophthalums* = *Carassius auratus* LINN.

1790

KIMURA, KÔKYO, 1790 (Genbun 1 Nen): Shokoku Igyôzu, vol. 1. (in Japanese).

The author made many illustrations and descriptions of freshwater and marine fishes of Japan. As for the freshwater fishes, he describes several following species.

1. *Oncorhynchus rhodurus*: This is called "Enoha" in Japanese and changes the name thrice during the life. The youngest one from autumn and winter is called "Shibako", the next stage from winter to spring is called "Enoha" and the last stage is called "Masu".

2. *Hymenophysa curta*: This fish is found in the River Ôi and edible. It looks like a loach, without scale and very mucous.

3. *Acheilognathus rhombea*: "Hirabote" This fish resembles with *Rhodeus ocellatus* (KNER) with red fin. Head and back are bright blue. *Rhodeus ocellatus* is called "Oshikibote" or "Yamatobote". Both are bitter in taste.

4. *Zacco platypus*, *Zacco temmincki* and *Liobagrus reini* are illustrated and described. *Zacco platypus* in June, the belly is red and bule on the lateral, and black on the head. This is called also "Asate Haya" or "Asaji Haya". The second name came from the habits which show the fish lives in shal-

low water of the river. *Zacco temmincki* is called "Yamaso Haya" in Japanese. The size of sex is different as the former species. In the summer of June, the belly changes red. "Ishi Haya" is a kind of this group and lives in still water. The back is bluish and luster. Some of them is provided with several black spots. The flesh is thick and white. "Binasyu Haya" has a dark yellow body with black striation on the belly. Tail and hand are small and narrow. "*Liobagrus reini*" is called "Akajo Haya" and looks like a spiny loach.

5. *Oncorhynchus rhodurus?* has a silvery body. In September, the tooth becomes black. The local man called "Kanetsuke".

6. *Oncorhynchus masou.* The body is small and bluish, with small scales. The belly is white and has a black parr mark on the back. In February, the body is light blue and the dorsal and caudal are light reddish yellow. After March, this grows rapidly, attaining 60 cm in body length. The body is dark, deep blue, without black parr mark. This trout is found at Hida-gun, Bungo Province.

1798

KIMURA, KOKYO, 1798 (Kansei 10 Nen): Shokoku Igyôzu, vol. 3. (in Japanese).

In this volume 3, the author describes on Shirouwo, including three kinds of this group, *Cottus japonicus*, *Oncorhynchus masou* and *Lampetra reisneri.*

Perhaps the author confused them with three kinds or "Shirouwo" of different species. One is caught in by net in the inlet of Nishinomiya, Seishu (Hyôgo Prefecture) in February and March. This kind may belong to the young of *Plecoglossus altivelis* which come into river or freshwater from the sea. The second one belongs to *Salangichthys microdon* which is caught at Hizen and Kuwana, Seishu. The fishing ground is Akasuga, Hamajizo, Kametsu, Fukusaki, Toyota and Ishikki of Seishu (Mie Prefecture). The third one is a young of sardine. It has seven black spots along the abdomen. The author describes "Gori", two species *Cottus japonicus* and *Gobius similis* included. *Cottus japonicus* is found in many current rivers of Japan and has a ventral sucker. We find it abundantly in the Kamo, Yamashiro, and fish it with straw mat together with pebbles on it at the bottom. It is also found in the Asano, Kaga (Ishikawa Prefecture) and caught with different equipment. The author also mentions *Oncorhynchus masou* found in the sea and in rivers. This fish is caught in the rivers of Ecchu (Toyama Prefecture), Echigo (Niigata Prefecture), Hida (Gifu Prefecture), Oshu (Tôhoku district), and Hitachi (Ibaraki Prefecture). A famous fishing ground is Zintsū River (Oyama Prefecture). They present it to the Emperor on the first day of January every year. Finally, the author mentions *Lampetra reisneri.* This is distributed in many rivers and very famous is the one found in Suwa Lake.

HIRASE, TESSAI, 1798 (Kansei 10 Nen): Nihon Sankai Meisan Zue, vols. 1-5. (in Japanese).

The author illustrates and describes many famous productions of land and sea. In the 4th volume, he descrides *Salangichthys microdon*, *Cottus japonicus*, *Oncorhynchus masou* and others. *Salangichthys microdon* are caught by square net in the entrance bay at Nishinomiya, Sesyû (Hyôgo Prefecture). In Hirae, Bizen (Okayama Prefecture) and Kuwana, Seisyû (Mie Prefecture), this fish is caught by gill net in the fishing grounds around Kuwana. The othre famous grounds are Akasuga, Hamajizo, Kametsu, Fukusaki Toyoda and Ishiki, and most of them are located in the estuary of the River Kiso. *Cottus japonicus* is famous in the River Kamo, Yamashiro Province (Kyôto Fu). There are two kinds of this fish, one has a round fin on the belly attaching to stones on the bottom of the river, other looks like a small gobius, with a black and white patterned dorsal fin. Fishermen put two mats in the shallow water of river, putting many stones on the mats. Two men raise one side of mats and other man stirs a bottom of river with wooden poles. Many fishes ascending the river, run on the mat and the fishermen raised the mats with hands on the land and caugt them easily. *Oncorhynchus masou* is found in the river and sea. The fish lived in the River Jintsû Echû (Toyama Prefecture) is very famous. It looks like Salmon, with small scales and red stripe on the body. This fish is presented to Emperor on the first of January in every year. When the Emperor Keikô crossed the village Tamaina in 88 year, fisherman presented this fish to him. *Lampetra planeri* is found in the Lake Suwa, Shinshû (Nagano Pre-

fecture). When the lake is frozen over in winter, the fishermen build a small cotage on the ice to take a rest. At the time of fishing, fishermen make a tunnel through ice and put a long line in the lake to catch fishes. In the end of this book, the auther mentions the fishes called "Kazika" in many countries. A fish lived in Ozu, Iyo (Ehime Prefecture), looks like a loach and croaks in night. This fish may be *Cottus japonicus*. A fish founded in Echigo Province (Niigata Prefecture) has a large head, with black patterns on body and white belly. This also croaks in night. It is common in mountain rivers. In Shikoku, it is called "Yamatonko" and "Dongurohaze" in Osaka. A fish founded in Kaga Province (Ishikawa Prefecture) has a large head and homocercal caudal fin. The dorsal is white. This also croaks in night, just like a rat voice. A fish called "Ishifushi" has two kinds. One has a ventral sucker attaching to stones and other has a spine on the fin, croaking in night. *Pseudobagrus aurantiacus* is called "Mikouwo" in Saga, Kyôto and "Mikojôrô" in Banshû (Hyôgo Prefecture). It has a red body and stings hand with a spine of the pectoral fin. *Cottus kazika* is called "Ararekago" in Echizen Province (Fukui Prefecture). This has a peculiar habit. When it hails, the fish go down the river with belly up. A fish called "Ishikurai" looks like a gobius without spines. A kind of Cottus is called "Ishiechi" or "Kawaokoze" at Fushimi, Kyôto, "Tachinawatonko" at Iyo (Ehime Prefecture), "Maru" at Saga Kyôto and "Muko" at Ômi (Shiga Prefecture). This fish lives on the bottom of river, attaching to stones, and is provided with spines on head and fins. It is common in the River Kamo, Kyôto.

1806

KOBAYASHI, GIKEI, 1806 (Bunka 3 Nen): Kogyokô. (in Japanese).

The author describes the freshwater fishes of the Lake Biwa. He has taken several prominent fishes as *Cyprinus carpio*, *Carassius auratus*, *Oncorhynchus rhodurus*, *Ischikauia steenackeri* and other from the Lake Biwa and explained with figuers.

1809

KOBAYASHI, GIKEI, 1809 (Bunka 6 Nen): Kogyokô 2 vols. (in Japanese).

The author describes the habits of the following species which are found in and around Lake Biwa. *Cyprinus carpio*, *Carassius auratus*, *Oncorhynchus masou*, *Ischikauia steenackeri*, *Tribolodon hakuensis*, *Plecoglossus altivelis*, *Parasilurus asotus*, *Anguilla japonica*, *Misgurnus anguillicaudatus*, *Gnathopogon elongatus*, *Pseudorasbora parva*, *Zacco platypus*, *Pseudogobio esocinus*, *Cottus japonicus*, *Chaenogobius isaza*, *Gasterosteus aculeatus aculeatus*, *Aplocheilus latipes*, *Oncorhynchus rhodurus*.

1810

WATANABE, KEISUKE, 1810 (publishing year unknown): Tankai-Gyofu. (in Japanese).

This book contains the descriptions of 33 species of freshwater fish (scaled fish) and 11 species of unscaled fish including Giant salamander, freshwater reptile and freshwater vivalve. The author described many species of his own observations. Here we have extracted important facts of each species.

1. *Cyprinus carpio*: This is a prominent fish found in Lake Biwa. After the rain in spring, the carp came up into a canal. Larger ones are mostly found around Chikubushima (one of a small islands of Lake Biwa). The largest one measures about 3 m., whose age may be 100 years or more. Superior fishes are found in the lower river of Seta region. This species are distributed widely, also found outside of Lake Biwa, in the Tone River, Jôsyû; the Chitose River, Chikugo; the Tenryû River, Enshû; those are inferior than those of Lake Biwa.

2. *Carassius auratus*: This is called "Funa" or "Mabuna" in Japanese. "Gengorobuna" and "Funa" are mostly found in canals and ponds around Lake Biwa. The large one is called "Gengrobuna", and it takes mud only. The other race is called "Mushifuna", mostly takes insects and found abundant in Lake Biwa. The one of a very slender form is called "Nigoro" and smaller one is called "Ganzo", the inferior specimen of Funa (*Carassius auratus*). The male of "Nigoro" is called "Kama"

and the female after spawning is called "Hera". The one of round and larger form is called "Hiwara" and tastes very nice.

3. *Hemibarbus barbus*: This fish resembles the carp in outer features but rather slender, provided with smaller scales. The fin is yellowish red, attaining 6 cm. in larger on.

4. *Mugil cephalus*: The young one is called "Ebuna". The large one is presented to the retainer every year. Most of this fish come from the city Yokkaichi and Kuwana, Ise Province and people call them "Isegoi".

5. *Oncorhynchus masou*: Two kinds of the species are found, one is living in river and the other in sea. They are quite similar in characters.

6. *Oncorhynchus rhodurus*: Two forms of them are found in Lake Biwa, one is blue and the other is white. After the rain during August and September, it comes out of the lake into current rivers. Black spots are found on the back near the caudal fin. The largest one attains 19–28 cm. and deposits eggs in August. It is inactive in the water and fisherman can easily catch with a spear or net at night, under a torch.

7. *Acheilognathus limbatus*: This is a kind of small minnow found in Lake Biwa and tributaries, around the lake. People call the minnow with a white dorsal fin "Shirobote", and the one with a red dorsal fin "Akabote". The latter is taken for a male, with nuptical color in the autumn. This fish is weak and people are amused to keep it in aquarium during summer.

8. *Gnathopogon elongatus caerulescence*: This fish is coming up into the river from a lake during March and April. In that season, a ripened ovary is found in female.

9. *Gnathopogon biwae*: This is larger than *Gnathopogon elogatus caerulescence* which is somewhat rare and inferior in taste.

10. *Salvelinus pluvius*: This fish is not found in Lake Biwa but in the current waters of mountain region.

11. *Oncorhynchus rhodurus*: Most of the fish are frequently found to have black and red spots, but some of them have no red spots. During March and April, it is found mostly in current waters and in lake.

12. *Plecoglossus altivelis*: This is found in Lake Biwa. They appear in the spring and then grow well, attaining 3 cm. in body length till July or August. In September they spawn and their bodies become slender and black. When they enter into a lake, they are caught in bamboo traps. In the Hikida River, Echizen and the Nagara River, Minô, cormorants are used for the fishing.

13. "Koayu", a small beformed *Plecoglosus altivelis*. This is one of the deformed of *Pl. altivelis*. They are abundant in Lake Biwa and quite similar to *Plecoglossus altivelis*. They are very slender and small, depositing eggs in winter.

14. *Pseudogobio esocinus*: This fish is mostly found on the sandy bottom of small streams and rivers; it has a large mouth and a slender pointed snout. It has small scales and light black patterns on the greenish yellow body.

15. *Sarcocheilichthys variegatus*: This fish is found in Lake Biwa and sometimes in current rivers.

16. *Cottus japonicus*: This fish is found in lakes and current rivers, and likes a bottom life. The head is large and broad, and the mouth large and pressed, the body greyish black with black patterns. The eggs are just like a grain of barley, adhesive, attaching stones or wood-roots. At night it croaks just like a frog.

17. *Chaenogobius isaza*: It is abundant at Wani, the western part of Lake Biwa. The body is small, about 3 cm. in length and rounded, provided with light black patterns. It looks like a young of *Pseudogobio esocinus* and *Cottus japonicus*.

18. *Zacco temmincki*: This is usually found in Lake Biwa and current rivers. The body is somewhat rounded, light colored, with very small scales. The snout is pointed and the mouth is large: a black transverse stripe runs along the sides of the body. The dorsal and ventral fins and ventral side are red. The male is more beautiful than the female, with a bright reddish purple color.

19. *Zacco platypus*: This is also found in Lake Biwa and current rivers. It resembles *Plecogolossus altivelis*. The body is light greyish blue on the back and somewhat flattened, the ventral fin is longer,

and the mouth is small. It lives in still waters in groups. The largest one is about 15 cm., comming up to heavy current rivers and jumping above the water surface. The female has a beautiful reddish purple color during breeding season and the snout is black with pearl organs on the surface.

20. *Opsariichthys uncirostris*; This is found in Lake Biwa, and ascends the rivers around the lake during May and June. The body is slender and compressed laterally. The largest one of the female is about 30 cm. The scale is white painted with light red. Male is larger than female, with somewhat deep reddish fins and many pearl organs on the snout.

21. *Ischikauia steenackeri*: It is found only in Lake Biwa, and not ascends the river. The body somewhat resembles to that of *Hemibarbus barbus* in the outer features. The body is broad, with a small head and small eyes; white on the whole, somewhat light black on the back. The ventral fin is yellowish red.

22. *Tribolodon hakuensis*; The body is somewhat large, measuring 20 cm. to 40 cm. in length. The scale is small. Three light black and red stripes are found on the sides.

23. *Aplocheilus latipes*; This fish is mostly found in shallow canals or small streams. The body is very small, measuring 4 cm. They are pelagic, forming a large group. In the spring, they deposit their eggs in weeds.

24. *Carassius auratus* (Gold-fish). According to "Yamato-Honzô", this gold fish was introduced from other places during 1620 (Genwa 6 Nen). This is not a native fish, but reared by people for hobby. They show many kinds of out-features and of various colored patterns. Some of them are provided with no dorsal fin.

25. *Cyprinus carpio*: Colored one is called "Higoi" in Japanese.

26. *Acheilognathus longipinnis*; This is found in the south of Lake Biwa but not in the north.

27. *Pseudorasbora parva parva*; This small fish is found in canals. The scale is black, with pearl organs around the mouth.

28. *Anguilla japonica*: The body is long and slender just as a snake, and yellowish brown on the back, without scales. The materials found in Seta and Kurozu of Lake Biwa are superior. The largest one is 900-1200 cm. The fish which is living in ponds and swamps is inferior. The materials from Kuwana, Seshû and Ôgaki, Mino are inferior.

29. *Lampetra japonica*: This looks like an eel; the largest is 45 cm. long with eight gill openings near the eyes. In the sea, Matsumae, Hokkaidô, the same species is found, which is larger than that Lake Biwa.

30. *Parasilurus asotus*: This fish is abundant in Lake Biwa and rivers around the lake. During the rainy season, some of them come up on the land. The black and white and spotted ones are found in the same species.

31. *Pelteobagrus nudiceps*; This is found in Lake Biwa and rivers. It looks like *Parasilurus asotus*. The body is black or yellow, and sometimes provided with many patterns. The head is large with minute teeth. The fishermen catch small ones for food. Two pairs of barbels are located around the mouth. The body is scaleless and the dorsal and pectorals are provided with spines by which the fish often stings the skin of human body. If the spines are moved, they sound weakly.

32. *Liobagrus reini*; It looks like a *Pelteobagrus nudiceps* in its outer feature. It is somewhat shorter and broad. The body is black, with red color. The poisonous spines on the pectoral fin, denticulated along the margin, exhibits a light sound. If it stings the human body, it is very painful.

1828

CUVIER, G. and **VALENCIENNESE,** 1828-48; Histoire Naturelle des Poissons. 22 vols. Paris.

The authors in 1844 determined 21 species, of which 6 were *Cyprinus* and 12 *Leucisi*. The 6 *Cyprinus* then were reduced to 2 species, *Carpio vulgaris* and *Carassius auratus*.

1833

KAGAWA, RANSAI, 1833 (Tempô 4 Nen): Reigyo, Vol. 1. (in Japanese).

The author recorded *Channa argus* in his book with a fine figure. It is said that a chinese MÔKANKYU presented fresh ten fishes to the governor of HIDAKA, Bungo Province, Kyûshû on the 5th, June of 1804 (Bunka 1 Nen). From his information, *Channa argus* was imported from China to Japan in early age.

1838

KURIMOTO, SHÔZÔ, 1838 (Tempô 9 Nen), Kôwa-Gyofu, vol. 1, pp. 1-34, figs. 1-63; vol. 2, pp. 1-7, figs. 1-14. (in Japanese).

This book consists of two volumes; the first volume mostly contains the descriptions of 51 species of river fish and the second contains those of 13 species of brackish water fishes. In the first volume, the following species are described.

1. *Cyprinus carpio*: The most superior fish is found everywhere of Japan. The specimen which got in the River Ôtome, Kobinata, Yedo (Recent Tôkyô) measures 150 cm. They made it medicine for human body.

2. Colored *Cyprinus carpio*: This fish seems to be introduced from Korea and is called "Chôsengoi". The variety of colors is abundant in this group.

3. Colored *Carassius auratus* (Gold-fish): This also exhibits many forms and a great variety of colors.

4. *Carassius auratus*: This species has many races. This first one called "Gengorô-buna" is the best one and the second one, "Mabuna" attains 30 cm. in body length. "Momijibuna" has a characteristic of red color in autumn and winter. "Marubuna" is caught mostly during winter and spring. The body is round and looks like a carp, and attains about 40 cm. in length. "Ebisufuna" shows a peculiar form and is very inferior.

5. *Acheilognathus moriokae*: This is found in current rivers and lakes. "Tanahira" is its local name at Zyoshû and "Hirame" at Bizen. In autumn, they change the color into red, and are called "Beni tanago".

6. *Acheilognathus longipinnis*: This is found abundantly in Lake Biwa. The body is very broad and flattened bilaterally. The head is small and compressed.

7. *Oncorhynchus rhodurus*: This fish is found abundantly in Lake Biwa. It looks like *Salvelinus leucomaenis*. The body is slender and has a black spot on the back, around the caudal fin. The larger ones measure 60 cm. in length.

8. *Ischikauia steenackeri*: This is found in Lake Biwa. Larger ones are called "Funawadaka" and smaller ones "Semushiwadaka".

9. *Opsariichthys uncirostris*: This is found in Lake Biwa. The body measures about 24 cm. in length, with silver small scales and with caudal fin margined in red color. They are quite active and very often jumping over the boat.

10. *Pseudogobio esocinus*: They are found abundantly in current water, swimming along at the bottom not on the surface of water.

11. *Therapon oxyrhynchus*: This is found in a hot spring at the foot of a mountain of Wado-mura, Itô, Zushu.

12. *Salvelinus pluvius*: This fish is distributed widely in current rivers of mountain regions. It looks like *Oncorhynchus masou*.

13. *Oncorhynchus masou*: This is found in the rivers of mountain regions. It looks like *Plecoglossus altivelis*. They have black markings on both sides and some of them have red spots.

14 *Plecoglossus altivelis*: This fish attains about 30 cm. in length. During August and September, the fish deposits eggs and then will die. But the fish in the Asami River, Tachiishimura, Hayami-gun, Bungo Province, does not deposit eggs till winter. Perhaps, some hot-spring is around or near the river for which the water temperature is kept somewhat warmer even in the winter time.

15. *Hymenophysa curta*: This is abundant at Kameyama, Tanshu and in the Katsura River, Zyoshu. This fish has barbels around its mouth as in *Misgurnus auguillicaudatus*.

16. *Zacco temmincki*: This fish is abundant in many rivers. The small one is called "Yanagihaya"

and used for the food of chickens.

17. *Zacco platypus*: This is abundant in current waters; the body attains 18 cm. in length and has red long ventral fins. They are swimming in groups, and jumping from the surface of water in and after these seasons, they are called "fighting fish". Those which are found in the Ôji River and the Ôtome River, in Edo (Recent Tôkyô), are called "Jissokko".

18. *Sarcocheilichthys variegatus*: It appears like *Opsariichthys uncirostris* and its head is like as "Okoze".

19. *Gnathopogon elongatus elongatus*: This is abundant in lake and rivers in Gôshû. In the Moroko River, this fish is most abundant. In Kyôto, this is usually used as congratulatory fish for national holidays.

20. *Coreoperca kawamebari*: This fish is abundant at Kameyama, Tamba. It has small green spots on both sides of opercle.

21. *Gasterosteus aculeata aculeata*: For this is famous the Ichi River, Echigo. The body is about 6-9 cm. with large scales on both sides. In Lake Biwa, this is called "Hariuwo".

22. *Aplocheilus latipes*: This fish is found abundantly in ponds and canals, swimming just under the surface of water. The red one is called "Himedaka" and the white one "Shiromedaka".

23. *Chaenogobius isaza*: This is called "Sanobori", and found at Wani, Gôshû.

24. *Channa argus*: This fish is not native and is called "seven star fish" for it having seven black spots along the body side. On the fifth of June, 1804 (Bunka 1 Nen) the Nagasaki magistrate, Bungo-nokami, Hida presented ten those fresh fish to the feudal lord (Daimyo).

25. *Anguilla japonica*: The most delicious freshwater fish is said to be this kind of eel. The specimen attains 300 cm. in body length and it is caught at the Haha River, Ashû.

26. *Lampetra japonica*: The famous materials are caught in the Arakawa River, Echigo. The body has seven pores arranged in a line behind the eyes which means an eel with eight eyes. We call "Yatsumeunagi" has eight pores, including seven gill openings and one eye. *Lempetra reisneri* is a different species and lives in current waters.

27. *Misgurnus anguillicaudatus*: This fish is very common in Japan, the other species *Cobitis taenia striata* is found in the clear water with sandy bottom.

28. *Parasilurus asotus*: The color is changeable in different environments. This fish has been used for medicine.

29. *Pelteobagrus nudiceps*: The author confused two different species *Pelteobagrus nudiceps* and *Pseudobagrus aurantiacus* into one. This fish has poisonous spines on the dorsal and pectoral fins. Sometimes they sting human body painfully. *Liobagrus reini* is found in Lake Biwa.

30. *Cottus japonicus*: This fish lives in the current rivers of mountain regions. *Cottus kazika* is distributed in Echizen Province. The body attains 21 cm. and very broad. They say that this fish exposes its face turning upward when it snows or blows in the winter time.

31. *Tridentiger trigonocephalus*: This is small *Gobius* with black patterns on the body. They are found abundantly in the Ryôgoku River, Edo (Recent Tôkyô). *Odontobius obscura* is found in Lake Biwa, and looks like a *Gobius* which is blackish brown with small scales. The largest one attains 180 cm. in body length.

32. *Mugil cephalus*: The fish lives in the river and descends to the sea. The smallest one is called "Oboko" and the middle one is "Ina" and the largest one is "Nayoshi" or "Bora".

33. *Lateolabrax japonicus*: The best season for the fish is summer and then it becomes slender and does not taste good after August.

34. *Coilia sestus*: This fish is found in Terae, Hizen, the Yanakawa River, Chikugo. They ascend to rivers during summer and attain 30-60 cm. in body length. After September, they hide in somewhere.

35. *Oncorhynchus keta*: This fish is abundant in the larger rivers of the northwestern parts of Honsyu. The first salmons appear during August and September.

36. *Oncorhynchus masou*: This is called "Haraaka" for its red belly. *Oncorhyncus nerka* is found in Hokkaidô and its flesh is bright red and taste very nice.

37. *Tribolodon hakuensis*: This fish is called "Kuki" in Jôshû. The larger one is called "Maruta" and abundant in the Tone River.

38. *Hypomesus olidus*: This fish is found somewhere. They are abundant in Mikata Lake, Zyakushû.

39. *Salangichthys microdon*: This fish is caught in winter and spring. In the Ryôgoku, Busyû, (Recent Tôkyô), rather abundant for fishing.

40. *Acanthogobius flavimanus*: It is caught in the brackish water in summer and then descends to the sea after September. There are many species found in the sea water. The other several fishes are described with their figures, but the author could not identify them scientifically, as the descriptions and figures were so brief.

1842

TEMMINCK, C. F. and SCHLEGEL, H., 1842: Fauna Japonicea, Pisces. pp. 1-323, Batavia.

This monograph is very important for the ichthyologists who study the Japanese fishes. Dr. v. SEIBOLD collected many specimens from various districts of Japan when he stayed there. The two authors describe 359 species including marine and freshwater fishes. 294 species are mentioned with fine colored figures in 159 plates. 36 species of freshwater fishes are included in this report. This species names are corrected by the recent ichthyologists into the ordinal ones. The species are as follows:

Cyprinus heamatopterus = *Cyprinus carpio*
Cy. conirostris = 〃
C. burgeri = *Cyprinus carassius langsdorfii*
C. cuvieri = 〃
G. barbus = *Hemibarbus barbus*
C. gracilis = *G. elongatus gracilis*
C. intermedia = *Acheilognathus lanceolata intermedia*
C. rhombea = *Acheilognathus lanceolata rhombea*
L. minor = *Zacco platypus* (young).
L. sieboldii = *Zacco temmincki*
L. variegatus = *Sarcocheilichthys variegatus*
L. pusillus = *Pseudorasbora parva parva*
C. maculata = *Misgurnus fossilis anguillicaudatus*
C. taenia japonica = *Cobitis biwae*
Poecilia latipes = *Oryzias latipes*
Silurus japonicus = *Parasilurus asotus*
Salmo (*Plecoglossus*) *altivelis* = *Plecoglossus altivelis*
Hemirhamphus sajori = *Hyporhamphus sajori*
Serranus kawamebari = *Coreoperca kawamebari*
Cy. melanotus = *Cy. carpio*
Carassius langsdorfii = *Cyprinus carassius langsdorfii*
C. grandoculis = 〃
Gobio esocinus = *Pseudogobio esocinus*
Capoeta elongata = *Gnathopogon elongatus elongatus*
C. lanceolata = *Acheilognathus lanceolata lanceolata*
C. limbata = *Acheilognathus lanceolata limbata*
Leuciscus platypus = *Zacco platypus*
L. temmincki = *Zacco temmincki*
L. uncirostris = *Opsarichthys uncirostris*
L. parvus = *Pseudorasbora parva*
Cobitis rubripinnis = *Misgurnus fossilis anguillicaudatus*
C. curta = *Hymenophysa curta*
Fundulus virescens = *Pseudorasbora parva*
Bagrus aurantiacus = *Pelteobagrus aurantiacus*
Coilia nasus = *Coilia mystus*
Perca-labrax japonicus = *Lateolabrax japonicus*

1853

BLEEKER, P., 1853: Bijdrage tot de Kennis der Ichthyologische Fauna van Japan. Uit. Koni. Akad., Wet. Amsterdam, p. 12.

The author described 15 species from the Japanese fishes collected at Shikoku, Kyûshû, & Honshû, by Dr. O. G. J. MOHNIKE. Two of these specimens collected at Kaminoseki, southern Honshyû, were identified with *Cobitis rubripinus* and *Monocentris cataphracta* BL. He has mentioned that the present species belong to marine fishes found at Kaminoseki and take the synonyms of Dojô Japanese and *Gasterosteus japonicus*. According to his descriptions, we have ascertained the former species may be included under *Misgurnus anguillicaudatus* (CANTOR) and the latter is named *Gasterosteus cataphractus*.

1856

BREVOORT, JAMES CARSON, 1856: Notes on the Figures of Japanese Fish taken from Recent Specimens by the Artists of the U. S. Japan Expedition. pp. 255-288, Washington.

This is the report of the Japanese fishes taken from the United States Japan Expedition, made by narrative commander M. X, PERRY. The report contains descriptions of 62 species of which 29 are figured on 12 color plates. In this report, the freshwater fishes *Salmo perryi*, *Salmo orientalis*, *Salmo leucomaenis*, *Salmo* young and *Osmerus olidus* are described. One of these *Salmo perryi* was described as a new species from Hokkaidô.

1860

BLEEKER, P., 1860: Ichthyologiae Archipelagi indici Prodomi. vol. II. Cyprini. Batavia Lange & Co.

In this report, the author establishes two new genera. One is *Acheilognathus* n. gen. by the type of *Acheilognathus melanogaster*. This species is now changed into *Acheilognathus lanceolatus lanceolatus* which is found in Japan. The other is *Gnathopogon* n. gen. by the type of *Gnathopogon elongata* which is also distributed in Japan.

BLEEKER, P., 1860: Zesde bijdrage tot de Kennis der Vischfauna van Japan. Act. Soc. Sc. Indo-Neerl. VI, pp. 1-104.

The author established two new genera. One is *Pseudorasbora* by the type species of *Leuciscus parva* and the other is *Pseudobagrus* by *Pseudobagrus aurantiacus*. He also described *Cobitichthys enalios*, which may be identified with *Misgurnus fossilis anguillicaudatus*. *Pseudobagrus aurantiacus*, *Acheilognathus melanogaster* (*A. lanceolatus*) and *Aplocheilus latipes* are added to the freshwater fish fauna of Japan in this report.

1862

BLEEKER, P., 1862: Atlas Ichthyologique des Indes Orientales Neerlandaises, publié sous les Auspices du Gouvernement Colonial Néérlandais. Amsterdam Frederic Muller. 1862. Tome I-VIII. (1862-1877).

This large monograph consists of eight volumes containing many marine and freshwater fishes from the India and other countries. The author established several new genera concerned with the Japanese freshwater fishes as follows.

Parasilurus BLKER by the species type of *Parasilurus japonicus* (Syn. *Silurus japonicus* SCH.); *Gnathopogon* BLKER by the type of *Gnathopogon elongatus* (Syn. *Capoeta elongata* SCH.), *Opsariichthys* BLKER by the type of *Opsariichthys uncirostris* (Syn. *Leuciscus uncirostris* SCH), *Pseudogobio* BLKER by the type of *Pseudogobio esocinus* (Syn. *Gobio esocinus* SCH.), *Sarcocheilichthys* by the type of *Sarcocheilichthys variegatus* (Syn. *Leuciscus variegatus* SCH.), *Pseudorasbora* by the type of *Pseudorasbora parva* (Syn. *Leuciscus parvus* SCH), and *Paracheilognathus* by the type of *Paracheilognathus rhombeus* (Syn. *Capoeta rhombea* SCH.).

1863

BLEEKER, P., 1863: Sur une nouvelle Espece de Poissons du Japon appartennant a un nouveau Genre. Versl. Akad. Amsterd., 15, pp. 257-260. Amsterdam.

The author established a new genus *Pseudoperilampus* by the type of *Pseudoperilampus typus*. This species is found in Japan.

1865

BLEEKER, P., 1865: Notice sur les Nome de quelques Genres de la Famille de Cyprinoides. Neder. Tijdschr. Dierk., 11, pp. 65-67. Amsterdam

In this report, the author established a new genus *Opsariichthys* by the type species *Opsariichthys uncirostris*.

KNER, R., 1865-67: Reise der Osterreichischen Fregatte "Novarra" und die Erde in den Jahren

1857-59, unter den Befchlen des Commodors. B. von Wullerstorf-Urbain. Wien, 1865-67, 40. The author described 4 new species, one of these *Pseudoperilampus ocellatus* was found in Japan.

1867

MATSUMORI, TANEYASU, 1867-1892: Ryou Hakubutsu-fu, vols. 1-59. (in Japanese).

Illustrations of fish and other animals in Uzen and Ugo districts (Recent Niigata and Iwate Prefectures) Freshwater fish.

The freshwater fish, described in this illustration, are including the fish widely distributed in rivers, streams, channels, swamps and ponds. Pure fresh-water and brackish-water fish exist in these districts. For example, eel lives in sea during winter and in river during summer. Salmon also lives in river in autumn and in sea during other seasons.

1. Eel, Cat-fish and Loach: They are different in outer features but they belong to the same group. Their skin is smooth, mucous and scaleless. The body is dark blue but their tastes are nearly allied. The author includes *Misgurnus anguillicaudatus* and *Lampetra japonica* in this group. He illustrates *Parasilurus asotus*, *Liobagrus reini* (sketched on July 22nd, 1885) and *Pelteobagrus nudiceps*, in color. The last species was abundant in the River Fujishima and Kurose in 1889. As for the loach, the author figures Madojô (Real Loach), Akagoma (red with black spots sketched on 3rd, April of 1886), Gomadojô (dark with black spots); Hidojô (red without black spots); Chadojô (light red with light black eyes, sketched on the 15th, August of 1885); Torafudojô (light red with large black spots along the back, and with white eyes and black pupils, sketched on the 15th, August of 1885); "Kaname" (local name in these districts) may belong to *Cobitis taenia striata*. It lives in the clear current waters with pebbly bottom. During spring, after the snow melts, it ascends into small streams and spawns in the upper streams. It tastes very good. The color variation exhibits itself in the same group; yellow and orange with different black patterns on the back and sides of the body.

2. Trout: Three races exist in trout; one is called "Kuchiguro" (sketched on 12th, April 1886) and others "Itamasu". Two of these allied to the forms found in mountain rivers and the remaining three rare. The young of trout allied to "Yamahae", is silvery and called "Hakusan-bae". "Kuchiguro", (figured on April 12th, 1886) the first race of trout, attains 30 cm. or more and has a black inside of mouth. "Itamasu" (figured on May, 24th, 1888) ascends mountain rivers during May and descends to the sea in autumn. Taste is very nice. The females are abundant in rivers while the males are very few. It attains 60 cm. in body length.

"Yamahai" (this may be "Yamame", land-locked form *Oncorhynchus masou*) is mostly male. Most fishermen understand that this race looks like the male of *Oncorhynchus masou*.

"Amemasu" (figured on March, 20th, 1885) is rarely caught in current rivers and not attains 30 cm. in body length. In the sea around Hokkaidô, 60 cm. or more specimens are caught. The flesh is light red and tastes very good. Yamabe was figured well on November, 16th, 1882.

3. Smelt and Dace: "Kuki" or "Akahire", (figured on July, 13th, 1885) both have red striations on both lateral sides of body, and ascend rivers during snowy season from the sea and spend their lives during summer in mountain rivers and then descend rivers into the sea. "Nigabae" (sketched on April, 25th, 1886) is called "Yanagi-Hai". It is found in the small limited area, just at the foot of a mountain in Kota-mura, east of Tsuruoka City. It is a small fish, attaining 1.5 cm. in body length. "Hai" (sketched on April, 7th, 1883). This may identified with *Tribolodon hakuensis*. The snout pointed and body elongate. This fish is caught at Mato-numa and the River Kiyokawa, and it attains 60 cm. in body length. "Wakasagi" is called by the local names as "Amehagi" or "Amesagi. (*Hypomesus olidus*). It is found in and around Yuri-gun, Yamagata Prefecture, and since old times it has been found in the River Mogami and Karasunuma. It looks like a small sardine and bluish white and transparent as *Salangichthys microdon*. A fish is caught by Mochi-ami, around Sakata harbour, is not real *Salangichthys microdon*. Perhaps it may "Shirasu" a young of Clupeidae.

4. *Acheilognathus* and its allies: "Kawatanago" is found in current and gentle waters. The body is flattened by lateral and broader in breadth. It is distinguished into 3 races: the first one is "Kawa-

tanago", very common, the second one "Beni-tanago" and the third "Shobu-tanago". The third one is male, reddish blue in color. The beautiful color may exhibits nuptial color in this group. "Bicha-tanago" (sketched on September, 10th, 1886) is found in the very gentle water. After summer. it grows well and descends rivers in autumn to die. Some of them live over the winter.

5. Carp and Crucian carp: This group is also distributed in ponds, swamps and current waters. The author distinguishes two races of this group. The first one is native, with small scales. The specimen which is obtained at the River Mogami and attains 75 cm. in body length, is called "Magoi". The second one is a cultured carp with red, black and whitish blue patterns. After the deluge of Tempô era (1883), this cultured carp has been living in many rivers and breeds naturally. *Carassius* is one species in native. "Higoi" is one of the natives and color race. It changes color in different environments.

6. Gold-fish: Gold-fish was one of the races of Crucian carp but not naturally found in Japan. After the deluge of Tempô era (1883), it has spread in the waters. In the Chôya Newspaper, published on 26th, October of 1884 a topic, of new species of Gold-fish was reported. Some notes by a breeder of Gold-fish, were reported in a German newspaper, which shows that recently the evolution theory has been believed by many people and human nature to seek after novelty. But the specialist could not distinguished a new species of Gold-fish. The Gold-fish is of Orient origin and it was cultured in China and Japan several hundreds years since. The number of species attains 58 species. Recently, the author has found a new species, the size of which attains 6 cm. in body length and it has bright scales. The belly is gold, bright reddish line running along the body sides, the fins bluish and greyish, and the caudal is dark gold. The breeding season occurs during June and September. During that time, the male has brighter scales and the female makes a nest of 6 cm. in diameter by gathering floating weeds. The female then gradually rolls up the caudal fin and waits for eggs entirely protruded from her body into water. While the male drifts the eggs to a nest by the time of the respiration and until hatching out of eggs, and swimming out from nest, he guards his offsprings not to be killed by enemies, spawning is carrying out during one to six hours afternoon when the temperature enough to grow the development of eggs. This is a recent discovery. The habit mentioned above, is probably of *Gasterosteus aculeatus aculeatus* not of the new species which was found by this author. The other species is very long, about twice of the preceeding species. The eyes extrude from the head, and it is scaleless. It likes to live in the narrow waters, the color of body is dark black at the time of hatching and gradually changes into white. The author considers a fish to be able to change the color by the use of light temperature, water weeds and aged trunks.

7. *Pseudorasbora* group: "Etarashi" (sketched on September, 2nd, 1883) is living in swamps, ponds and ditches. The bird keeper always uses this fish for bird-food. The body attains 9 cm.

8. *Zacco* group: "Migo" lives in the clear current waters. The body is somewhat flattened bilaterally or elongated. It attains 15 cm.-18 cm. in usual rivers, while in the River Mogami it attains 30 cm. it body length.

9. *Pseudogobio* group: "Kawakisu" group consists of one species *Pseudogobio esocinus* (sketched on July, 28th, 1885). While fresh, the body is brown with black patterns, after the death, the black patterns become more distinctive. At the end of the rainy season, it ascends rivers. The larger one attains 15-18 cm. in body length.

10. *Gobius* group: During winter and spring, *Gobius flavimanus*, (illustrated on September, 2nd, 1883) lives in the sea and after the rainy season, it ascends rivers. This gobius is called "Kugi-hae" and still small at that time. Then it grows to 15-18 cm. In the harbor Sakata they can catch about 21-24 -30 cm. sized adults by angling. The author has never heard of any other localities where such large ones are angled.

11. *Cottus* group: In Japan, we have two kinds of "Kazika". One is a frog (*Polypedates buergerii*) and the other is the fish which is mentioned here. The *Cottus* is not a fish swimming but staying near the bottom of the waters on the belly, to watch small animals. If it finds a movable thing, it proceeds suddenly to catch. The body has a large mouth and head is cubical. "Gûnzo Kazika" divides into two races. One has no patterns, and the other is common and lives only in rivers. "Takazika"

(illustrated on February 22nd, 1886) has black fins and is rare. It lives in paddy fields and narrow canals. During the rainy season, it is caught in abundance in small streams. "Tsutsumi-kazika" is small and tastes very nice. It spawns in spring. "Ohakazika" (sketched on February 9th, 1891) is a small fish with eggs in the belly. The larger one is caught in a small river around "Nagashima Omote Yama". "Kazika" near Akahashi. In a stream near Akahashi bridge of Hachiken-chô, Tsuruoka City, the author caught special species (sketched on September 26th, 1891). The flesh is very nice. When he caught it, he agreed it to belong the young of "Kazika". "Ukizako" found near Oyamatsutsumi. In June, there are abundant small fishes (sketched on June 25th, 1890) near Oyamatsutsumi. They are sold in the fish market and made appreciation. It is said that the fish is a peculiar one. The author remarks that a fish may belong to a young of "Gunzo". "Enomi Kazika" is distinguished into two races; on is real "Maenokazika" and the other is a species allied to "Nabekazika" except coloration. Both are living in large rivers and not in small canals. "Enomi-Kazika" looks like "Nabekazika" in form and nature. It has a large mouth and small belly. The body is black, provided with reddish blue patterns. "Ishimochi-kazika" (sketched on June 11th, 1885) lives in the current waters only. It hides among large stones at the bottoms of the rivers Mogami and Akagawa. Sometimes it likes to swim in the current waters. The feature is great but the skeletons are rather soft (sketched on August 11th, 1885). "Ayukake" looks like "Ishimochi" and is large in size. The feature is somewhat great, and it has pointed spines on the ventral and stings a *Plecoglossus altivelis*; from this fact comes the present name. The individuals which live in the current waters attain 15–18cm. and sometimes attain 39cm. in size. The black specimen collected from the River Fukuyama, Kaihô-gun attains 30cm.

12. *Mugil* group: The largest one that attains 60cm. in body length is found in the River Mogami, Niigata.

13. *Aplocheilus* group: "Urume" is a local name of *Aplocheilus latipes*. "Shumedaka" looks like a colored carp, somewhat lighter in color than the latter. During the KAEI Era (1848–1853), this species came from other districts but it is not found recently. Among many numbers of common *Aplocheilus latipes*, pure yellow ones are rarely found. If we catch them and rear for a long time, they change the color into black within one night.

14. *Gasterosteus* group: The female has no spine while the male has. After the snowy season, they come up the River Mogami and "Akayawa" from the sea. The fish is very fatty. Most of the poor like to eat it and the price is somewhat high. It spawns in small canals, making a nest with hairs. This is distinguished into two races; one is very common (sketched on April 26th, 1883) and the other is yellow. After the melting of snow, it makes a nest with slender roots of grass in the waters and deposits asmall light yellow eggs in the nest. If the enemies attack the nest, the male opens his mouth to protect his eggs and youngs.

15. Flat-fish group: Only one species (*Platichthys stellatus*) is found in freshwater. About 4 kilometers above from the mouth ot the River Mogami, there they are abundant on the sandy bottom of "Komaki-mura"; further more about 14km. above, there is a fishing ground near "Mitsuhashi", Tsuruoka City.

16. *Hemirhamphus* group: This group is not certain and said to be rarely found near "Shimonobe" during winter. The form looks like *Hemirhamphus* and lives in the current waters.

1868

GÜNTHER, ALBERT, 1868: Catalogue of the Fishes in the British Museum. Vol. 7, Catalogue of the Physostomi containing the Families Heteropygii, Cyprinidae, Gonorhynchidae, Hyodontidae, Osteoglossidae, Clupeidae, Chirocentidae, Alepocephalidae, Notopteridae, Halosauridae in the Collection of the British Museum. pp. 1–512.

The author discussed a number of species preserved in the British Museum, among which the specimens from Japan were described. He included three species; *Carpio haematopterus*, *C. melanotus*, *C. conirostris* under the synonym of *Cyprinus carpio*, originally described by SCHLEGEL from these same

specimens collected by SIEBOLD in Lake Biwa. Related to *Carassius auratus,* the author also included three species of *C. langsdorfi, C. cuvieri* and *C. grandoculis* described by SCHLEGEL from the specimens from Lake Biwa. He has observed the adult specimen of *C. langsdorfi* preserved in the Lyden Museum and the half grown specimen of *C. cuvieri* from the Lyden Museum as well as young of *C. bürgeri* from the Lyden Museum and from BLEEKER's collection. On page 175, the author described *Pseudogobio esocinus* from a half grown specimen preserved in the Lyden Museum, and *Pseudogobio* (*Sarcochelichthys*) *variegatus,* preserved in the Lyden Museum, by the help of Dr. BLEEKER who examined the specimens at his request. *Pseudorasbora parva* was mentioned on page 186 from a three inches long specimen in Dr. BLEEKER's collection in Japan. Concerning the species of the genus *Acheilognathus,* he has described *A. limbatus, A. intermedius, A. melanogaster* and *A. rhombeus.* The specimen of *A. melanogaster* from Dr. BLEEKER's collection, was collected at Jeddo (Tôkyô) and of *A. rhombeus* was preserved in the Lyden Museum. On pages 281, *Pseudoperilampus typus* was described from the type specimen, 3 inches long, from Dr. BLEEKER's collection. About the species of *Opsariichthys,* he has mentioned three types, 1st on is *O. uncirostris,* the 2nd one is *O. sieboldii* and the 3rd one is *O. temminckii* from the young specimen preserved in the Lyden Museum. Furthermore he described *O. platypus* (*Zacco platypus*) from the typical specimen in the Lyden Museum, the adult one from Dr. BLEEKER's collection, and one of the typical specimens of *Leuciscus minor* preserved in the Lyden Museum.

1870

BLEEKER, P., 1870: Neuvieme Notice sur la Fauna Ichthyologique du Japon. Versl. Akad. Wet Amst., (2). 3. pp. 237–252, Amsterdam.

The author established a new genus *Acanthorhodeus* by the type of *Acanthorhodeus macropterus.*

1879

BLEEKER, P., 1879: Enumération des Espèces de Poissons actuellement commes du Japon et Description de trois Espèces inèdites. Verh. Akad. Amsterdam 18, pp. 1–33.

In this report, the author described 546 marine and freshwater fishes collected in Japan, 55 species of which belong to freshwater fish. The species are as follows: *Cottus pollux* GÜNTH., *Gasterosteus obolaius, Aulichthys japonicus* BREV., *Mugil haematocheilus* SCH., *Mugil japonicus* SCHL., *Odontobutis obscura* BLKR., *Gymnogobius macrognathus* GILL, *Ctenogobius gymnauchen* BLKR., *Acanthogobius flavimanus* GILL, *Chaenogobius annularis* GILL, *Rhinogobius similis* GILL, *Tridentiger obscurus* GILL, *Pseudobagrus aurantiacus* BLKR, *Parasilurus japonicus* SCHL., *Botia curta* GÜNTHER (*Hymenophysa curta*), *Cobitis taenia* L., *Misgurnus dichachrous* GÜNTH., *M. enalios* BLKR., *M. anguillicaudatus* GÜNTH., *M. polynema* GÜNTH., *Carpio vulgaris* RAPP., *Carassius auratus* BLKR., *Pseudogobio esocinus* BLKR., *Acheilognathus intermedius* BLKR., *A. melanogaster* BLKR = *A. lanceolatus, A. limbatus* BLKR., *Paracheilognathus rhombeus* BLKR. = *A. rhombeus, Hemibarbus barbus* BLKR., *Gnathopogon elongatus* BLKR., *G. gracilis* BLKR., *Sarcocheilichthys variegatus* BLKR., *Pseudorasbora parva* BLKR., *P. pusilla* BLKR., *Leuciscus hakuensis* GILL, *Barilius minor* BLKR. = *Zacco platypus, B. macropus B. macropus* BLKR., *B. platypus* BLKR. = *Zacco platypus, B. ? coreensis* BLKR, *B. sieboldi* BLKR., *B. temmincki* BLKR. = *Zacco temmincki, Opsariichthys uncirostris* BLKR., *Pseudperilampus typus* BLKR., *Aplocheilus latipes* BLKR., *Fundulichthys virescens* BLKR = *A. latipes., Hemiramphus sajori* SCHL., *Salmo orientalis* PALL., *S. perryi* BREV., *S. leucomaenis* PALL., *S. sp., S. macrostoma* GÜNTH., *Plecoglossus altivelis* (SCHL.) *Hypomesus olidus* GÜNTH., *Coilia nasus* GÜNTH. = *C. sestus.*

1880

GÜNTHER, ALBERT, 1880: An Introduction to the Study of Fishes. Vol. XVI, pp. 1–720, Figs. 1–321. Edinburgh.

In this book he has discussed the distribution of freshwater fishes and noted about the fishes of Japan on page 243. He has described as follows. "The Japanese Islands exhibit a decided Palaearetc

fish-fauna, which includes *Barbus* and *Cobitioids*, forms strange to the North American fauna. A slight influx of tropical forms is perceived in the south of Japan where two Bagridae (*Pseudobagrus aurantiacus* and *Liocassis longirostris*) have established themselves for a considerable period, for both are peculiar to the island, and have not been found elsewhere." From our studies of the distribution of fishes, quite agree with his statement.

1882

ISHIWARA, SHIGESUKE, 1882: Notes on *Plecoglossus altivlis*, Dainihon Suisan-kaihô,* (3), pp. 35–36, (in Japanese).

The author reports that very few of the young of *Plecoglossus altivelis* ascend the River Sakawa, Kanagawa Prefecture. In this case, the fishermen can catch the adult abundantly in autumn. These facts are not yet explained scientifically by the authorities. Some authortiy explains that when a small flood occurs in early spring, the youngs of *Plecoglossus altivelis* are caught abundantly. They are quite active and like to live in the clear and transparent waters. If no blood occurs, the stones and pebbles are spoiled by floating mud in the water and the youngs do not like to ascend along the coast, and the harvest in the autumn is poorer.

1883

SAUVAGE, H. E., 1883: Sur une Collection de Poissons recueille dans Lac Biwako par M. F. STEENACKERS. Bull. Soc. Philom. Paris (7), 7, pp. 144–150.

The author mentions many specimens collected by M. F. STEENACKERS from Lake Biwa. The species are named by the previous ichthyologists into the ordinal specific names.

Acheilognathus steenackeri = *Ach. rhombeus*
Opsariichthys steenackeri = *Ishikauia steenackeri*
Moroco steindachneri
Squalius caerulescens = *Gnathopogon elongatus caerulescens*
Squalius japonicus = *Gnathopogon japonicus*
Tribolodon punctatum = *Tribolodon hakuensis*
Opsariichthys platypus = *Zacco platypus*
Opsariichthys uncirostris
Pseudogobio esocinus
Pelteobagrus nudiceps
Silurus asotus = *Parasilurus asotus*

1884

HANDA, SUIZAN, 1884: Aquatic Animals. pp. 1–316. Tôkyô, Bunkaisha. (in Japanese).

The author mentions 257 spp. of aquatic fishes and animals in Japan. From his descriptions of fishes, here, in this book, we take out only the descriptions of freshwater fishes.

1. *Cyprinus carpio* "Koi": The specimen from the River Yodo is called "Mokazuki" and it is provided with a small head, flat body, long equal as broad. The color is black and yellow in winter. "Ômigoi" is produced in Lake Biwa. The head is small, round. People say that "Ômigoi" is superior than "Yodogoi".

2. *Hemibarbus barbus?* "Migoi": It looks like a carp, white in color with an interungled in yellow gold, and fins yellowish red, the larger one about 6 cm. in length. In general, this looks like a carp, with a round head and large eyes.

3. *Carassius auratus*: "Gengorobuna" is a large carp, in spring it lives only in lakes and during August to September it comes into creeks. As for other races, "Kinbuna" has gold color, "Marubuna" is round, somewhat large as a carp. "Nigoro" is of somewhat large size whose inside of buccal cavity is black. It is about 3 cm. in body length. "Yogobuna" resembles "Mabuna", distributed in the 50–60 fms. of Lake Yogo. "Ganzo" is fishing in all the seasons.

4. *Acheilognathus* sp.: A small fish distributed in current waters. The body is flat, 3–6 cm. long.

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* Dainihon Suisan-kaihô is a Periodical Magazine published by Dainihon Suisankai (Japanese Fisheries Society).

Many races are found in this group; say, "Shirotabira", "Akatabira", "Aotabira", "Kurotabira" and "Kitabira".

5. *Gnathopogon* sp.: This is the "Hae" group, including many species; "Moroko", "Haya", "Hai", "Yanagibae", "Shirobae", "Oikawa", "Ishimoroko".

6. *Hypomesus olidus*: This is abundant in Lake Mikata. Small, 1.5–1.8 cm. in length.

7. *Opsariichthys uncirostris* "Hasu": This fish is distributed only in Lake Biwa. The body is round and has very small silver scales. During autumn and winter towards spring this does not ascend and lives in open lakes but in summer it ascends. Both female and male are blue on the back and white on the belly. In the summer, the male changes light purple on the belly and looks very beautiful.

8. *Zacco platypus*: This is abundant in current waters. It looks liks *Zacco temmincki*. The head is round, the body being light black, with light yellow patterns.

9. *Hymenophysa curta?* "Ayumodoki": It lives in a current river and in a spring. It has no scale and the body is rather black from belly to vent with black stripes running along.

10. *Ischikauia steenackeri* "Wataka": This looks like "Hasu" in feature and taste. It lives abundantly in the Lake Biwa.

11. *Tribolodon hakuensis*: This is abundant in Lake Biwa. In March and April, it ascends from the lake into the rivers.

12. *Oncorhynchns macrostoma* "Yamabe": The body has a black pattern and several red spots on both sides. The scales are very small and it lives in upper rivers.

13. *Plecoglossus altivelis*: This fish has many local variations. The feature is somewhat small, narrow and short. The youngs are hatched out is shallow waters between the sea and the river in the spring. During the summer it grows up but after the autumn it tastes no good. It takes freshwater microplants. The Ayu which distributed in the River Asami, Tachiishi Mura, Hayami-gun, Bungo Province does not descend until winter. The female has a small head and the body is broad, thin, yellowish.

14. *Oncorhynchus keta* "Sake": This fish resembles *Oncorhynchus masou*, with large scales. The body is white on the belly and flesh is red. Ovary is well developed, red, transparent and delicious. In the breeding season, the snout of the male is curved and long, just like an elephant's trunk.

15. *Coreoperca kawamebari* "Kawamebaru": It lives in mountain rivers and ponds. It is about 6–9 cm. in body length, looking like a cruscian carp. The color is yellowish black but changes the color by environments.

16. *Hymenophysa curta* "Ayumodoki": It looks like an Ayu in color and shape, it is provided with barbels like a loach.

17. *Pungitius pungitius*: It is originally described as found at the River Itoi, Niigata Prefecture. It has small white scales and with 2 spines on the back and 4 spines on the belly.

18. *Gasterosteus aculeatus aculeatus*: It is produced in Kanagawa and Ishikawa Prefectures and 3 cm. in length 7 spines on the back.

19. *Sarcocheilichtys variegatus*: It is produced in Ômi, Shiga Prefecture.

20. *Aplocheilus latipes*: This has many local synonymes. The size is somewhat small, the head large with an upward directed mouth.

21. *Carassius auratus* var. (Gold-fish): This was introduced from other countries during the Genna era (1615).

22. *Anguilla japonica*: This fish is abundant in Fukui and Shiga Prefectures, and few in the River Uji, Lake Biwa, Shiga Prefectures, and in Kuwana, Mie Prefecture. This species has many local names; "Gomaunagi" (at Hizen, at Akita,) "Taniunagi" (the River Totsu, Yoshino-gun, Wakayama Prefecture) "Akaunagi" (at the River Yumesaki) "Shirounagi".

23. *Anguilla mauritiana* "Kanikui": This has a large head, with a flat mouth, red inside. This is very fond of small crabs.

24. "Ounagi": This giant eel, measuring 180 cm. in length and 15 cm. in diameter, is caught at the River Nuno-Shita, Nunoshita village, Kôchi Prefecture. The other giant eel, measuring 180cm. is caught at the River Funatsu Kumano, Wakayama Prefecture.

25. *Petromyzon reisneri*: This fish is living in a stream or in a lake. It looks like an earthworm, in light red, without scale, seven gill pores arranged behind each eye. It is abundant in the lake of Suwa, Nagano Prefecture.

26. *Parasilurus asotus*: This fish grows into very large. Mr. KIUCHI caught a large one measured 210–240 cm. in length at Oura, Chikubushima, Lake Biwa. This fish has many individual names for the many individual variations. "Oonamazu" (at Lake Biwa), "Gomanamazu" (the specimen has many patterns), "Akanamazu" (the body red, living in a stream or a clear pond). "Kuronamazu", "Shironamazu" are also individual names for the color variations.

27. *Pelteobagrus nudiceps* "Gigi": This fish has spines on both sides of pectoral fins and dorsal fin. These spines stick us harmfully. In general, it is rather small, measuring 12 cm.–21 cm. The specimen found in Lake Biwa is large, measuring 30 cm or more in length.

28. *Misgurnus anguillicaudatus*: This has several color variations, yellow, red, grey etc. This fish is distributed in streams and shallow ponds.

29. *Cobitis taenia biwae*: This is living in clear-water canals.

30. *Cottus pollux*: It looks like a gobius, with a large mouth and very small scales. The body is light yellowish with black patterns. The eggs are adhesive on the stones. In the evening, this fish is croacking just like a frog. The fish is usually living in the cave of rocks under water. "Isaza": This is a small fish, ascending a river in spring and look like a gobius.

31. *Gobius*: This fish is abundant in the estuaries of the rivers of Ôsaka and other localities. Back is yellowish brown, belly is white or light yellow, with a light red band around the mouth. There are many species belonging to this genus.

"Torahaze"· The patterns on the back look like the black tiger pattern; "Koromohaze" is called also "Anahaze", "Isohaze", "Kurohaze", "Gorihaze" or "Bozuhaze" in Japanese.

"Tobihaze"· This fish has a prominently projected eye and walks with the pectoral fins on the shore and rocks, sometimes jumping into the water by the help of the pectoral fins.

32. *Coilia sestus*: This is an anadromous fish, ascending from the sea into rivers and firstly recorded as found at Hizenziko, the River Yanagawa, Chikugo Province. It varies from 18 cm.–360cm. in length, with silver scales.

33. *Salangichthys microdon*: This is recorded as found from the River Ryôgoku, Tôkyô. The body is flat and long, and it is caught at the estuaries of many rivers in Japan. It is 6–9cm. long, white and transparent, with minute black spots along the belly and black eyes.

1889

FUJIKAWA, SANKEI, 1889: Suisan-Zukai, vols. 1–2. vol. 1, pp. 1–41, figs, 1–234; vol. 2, pp. 1–38, figs. 1–210. (in Japanese).

The author published a picture book, consisting of two volumes. The first of these volumes contains freshwater and marine fishes and the second volume also contains fishes, marine mammals, shells and other marine animals and sea-weeds. The 81 freshwater fishes described in the first volume with brief figures and descriptions are as follows.

1. *Cyprinus carpio*: (the Yodo River, Jôshû; Lake Biwa, Omi; Matsue, Unshu; the Sumida River, Bushu; Minowada, Jôshû; Suwa Lake, Shinshû). The author says that the carp is the largest fish found in freshwaters, with 36 scales on each lateral with a small black spot.

2. *Hemibarbus barbus*: This resembles *Tribolodon hakuensis* and has many local names.

3. Colored carp: This was introduced from Korea and is called Korean carp. This has various color patterns with black, white, green, bluish color.

4. *Salvelinus pluvius*: It is called "Akahara" or "Kashimagoi" in Japanese, found in rock caves. It looks like *Oncorhynchus masou* with yellow eyes.

5. *Carassius auratus*: "Gengorobuna" found in Lake Biwa is the best superior race of this fish. The other races are called "Mabuna" and "Momijibuna".

6. *Acheilognathus moriokae*: (Jôshû, Bizen).

7. *Salvelinus leucomaenis*: (Biwa Lake).
8. *Ischikauia steenackeri*: (Biwa Lake).
9. *Oncorhynchus keta*: (Matsumae, Hokkaidô; Ôshu; Tone River, Nuno River, Bushû).
10. *Oncorhynchus masou*: (Jintsu River, Echû; Hokkaidô; Hida, Echigo; Hitachi, Ôu).
11. *Acheilognathus longipinnis*: (Biwa Lake).
12. *Pseudogobio esocinus?*: (Yodo River, Ôsaka).
13. *Therapon oxyrhynchus*: This lives in the hot spring.
14. *Sarcocheilichthys variegatus*: (Biwa Lake).
15. *Tribolodon hakuensis*: This fish has many different local names as "Kuki", "Ida", "Ugui" and "Maruta".
16. *Zacco platypus*: (Tone River, Bushû). It is used for the food of chicken.
17. *Cottus pollux*: (Kamo River, Jôshû). This lives usually on the pebble bottom of the river, sucking on the stones by the ventral sucker.
18. *Mugil cephalus*: They say that this fish is originated from the river and goes down into the sea. The young is called "Oboko" in Japanese and the larger ones are called "Ina", "Subashiri", "Nayohi" and the final largest one is called "Bora".
19. *Lateolabrax japonicus*: (Matsue, Unshû; the Komatsu River, Bushû). The small one is called "Seigo" in Japanese and the larger one is called "Fukko". The largest one is called "Suzuki".
20. *Anguilla japonicus*: The record of the size of this fish is 180 cm. in length and 30 cm. in round and 10 kg. in weight. (Katada, Goshû; the Tone River, Bushû; Imbanuma, Shimoosa.
21. *Misgurnus anguillicaudatus* and *Cobitis taenia striata*: Albino loach is found Nozawa, Saku-gun Shiusyû.
22. *Lampetra japonica*: (the Ara River, Echigo; Iwafune-gun, Echigo; Kanbara-gun Echigo).
23. *Plecoglossus altivelis*: (the Tamashima River, Hizen).
24. *Pseudobagrus aurantiacus*: (the Hotsu River, Tamba)
25. *Pelteobagrus nudiceps*: (Biwa Lake; Mito).
26. *Hymenophysa curta*: (Kameyama, Tamba; the Katsura River, Jôshû).
27. *Zacco temmincki*: This fish is called a fighting fish. When they are swimming in the current, they make a group and sometimes they bite their caudal fins. When they are much surprized they jumped up above the water.
28. *Parasilurus asotus*: This fish changes the colour by the different background. The fish in current waters show bluish yellow and those in still waters show bluish black.
29. *Trachidermus fasciatus*: (the Kamo River, Kyôto).
30. *Pseudogobio esocinus*: (Kyôto; Hikone).
31. *Gnathopogon elongatus caerulescens*: (Kyôto; Sakamoto, Gôshû; the Yodo River, Jôshû).
32. *Hypomesus olidus*: (Suruga; Hôki; Izumo; Mito; Kasumigaura).
33. *Gasterosteus aculeatus aculeatus*: (the Itoi River, Echigo; Biwa Lake; Hokkaidô).
34. *Leucopsarion petersi*: (the Yodo River. Jôshû)
35. *Salangichthys microdon*: (the Minato River, Ouchi-gun, Sanuki).
36. *Chaenogobius isaza*: (Biwa Lake).
37. *Opsariichthys uncirostris*: (Biwa Lake).
38. *Mogrunda obscula*: (Kyûsyû).
39. *Oncorhynchus masou*: (Nikkô, Yashû).
40. *Coreoparca kawamebari*: (Kameyama, Tanba).
41. *Cottus pollux*: It lives in clear current waters. They say that it croaches at night.
42. *Trachidermus fasciatus*: (Echizen).
43. *Coilia sestus*: (the Yanagawa River, Chikugo; Tranoe, Hizen). The young comes up to the river during summer.
44. *Liobagrus reini*: The body is yellowish brown and it has sticking spines on both pectoral fins.
45. *Aplocheilus latipes*: This fish is found in ponds, swamps and canals forming a group on the surface of water. The red one is called "Himedaka" and the white one "Shiromedaka".

46. *Carassius auratus*: The gold fish was introduced by a Danish during "Genwa" years. The other remaining fish could not be identified scientifically, as the descriptions were so brief and figures so simple.

1890

SHISHIDO, ICHIRO, 1890: Note on *Gasterosteus*. Zool. Mag.* 2 (26), pp. 111-115, figs. 1-3. (in Japanese).

The author treated a systematic study on Japanese *Gasterosteus* and described 4 species in the present paper.

1. *Gasterosteus noveboracensis* C. et V.: Locality: Atsukeshi, Hokkaidô.

2. *Gasterosteus gymnurus* CUV.: Locality: Gifu City, Mino Province. The author says that the above mentioned two species are included into one species *Gasterosteus aculeatus* L. by GÜNTHER. If we agree with him, the species name may be changed into as follows: *G. aculeatus* L. var. *noveboracensis* C. & V. and *G. aculeatus* L. var. *gymnurus* CUV.

3. *Gasterosteus pungitius* LINN.: Locality: Hokkaidô and Inokashira pond, Musashi Province. The author found some difference in the two specimens from Hokkaidô and Inokashira pond, Musashi Province. Mostly, the specimen obtaind in Inokashira pond, has a smaller body but somewhat bigger than the specimen from Hokkaidô. The most famous Japanese stickle-back called "Itouwo", from the Itoi, Echigo Province will be identified with the three species just mentioned above. He suggests that the specimen will be included under *Gasterosteus aculeatus* or be one of the varieties of that species. From his considerations on the Japanese stickle-backs described by many preceding authors, he concludes that the above mentioned species will be distributed in the following localities.

4. *Gasterosteus noveboracensis* is distributed in Hokkaidô; the Itoi, Echigo Province; the Koyoshi, Yuri-gun, Ugo Province. This is called "Itouwo" in Japanese.

5. *Gasterosteus gymnurus* is called "Kawasaba" in Japanese and is distributed in Gifu, Mino Province.

6. *Gasterosteus pungitius* is called "Togeuwo" and distributed in Hokkaidô and Inokashira Pond, Musashi Province. The specimen called "Hariuwo" is found in Kanazawa. It is quite doubtful to include it in the species just mentioned above and perhaps it may be a different species.

MATSUBARA, SHINNOSUKE, 1890: Notes on *Cyprinus carpio* and *Carassius auratus*. Zool. Mag. 2 (26), pp. 540-542. (in Japanese).

The author mentions the general aspect of the two species, *Cyprinus carpio* and *Carassius auratus*. The common carp originated from Central Asia; inhabiting in the rivers, it runs into Black Sea and Casbian Sea. In old times, this was introduced into South Europe and then gradually into North America. In Japan, it might have been transplanted from China. The common carp in Japan is called "Magoi" in Japanese. Some scaleless carp (*Cyprinus nudus*) and some others which have large scales in a lateral line (*Cyprinus macrolepidotus*) are included into a variety of typical carp. They are cultivated mostly in Europe. The variations of scale number and size occur in different localities, and the interbreeders are also discovered in many places. "Higoi" and "Madaragoi" are mostly breeding in Japan and China, and not in Europe. They prefer warm water, but in Japan, they are transplanting them from the south into the northern parts. The breeding season occurs from May to August in Japan. During this period, most of the females induce the males into shallow water where the weeds are abundant, and deposit eggs on water plants. The eggs are light yellowish, of 1.5 mm. in size. The eggs in a female number 300-700 thousand. It's natural food is mostly small crustaceans and infuzorians, and phytophagus only while young. *Carassius auratus* is distributed in Japan, China and neigzhbouring islands, but not in Europe and America. Two different races are found; one is larger, called "Hirabuna" and "Gengorobuna" of Lake Biwa and the other is smaller, called "Maru-

* Zool. Mag. = Zoological Magazine (Dobutsugaku Zasshi) published by Zoological Society of Japan, Zoological Institute, Tôkyô University.

rubuna", living in ponds and canals. The breeding season comes around in May and June. In these months, they are making a group of males and females, swimming among weeds. They deposit eggs on weeds. The number of eggs in a female amounts to 300 thousand. Gold-fish, one of the varitiės of *Carassius auratus*, is breeding in China and in has been introduced into Japan. Recently they are keeping it in Europe.

1891

MATSUBARA, SHINNOSUKE, 1891: The Age, Spawning Habit and Development of *Plecoglossus altivelis*. Dainihonsuisan Kaihô, 114, pp. 590-592. (in Japanese).

The author reports that this fish lives one year or more, keeping over the winter. This is called "Tomari Ayu". The head is somewhat larger and the body is slender, with no yellowish red spot. In the pond of the Ritsurin Park, Takamatsu, Kagawa Prefecture, the fish spawns and its eggs are attached to the pebbles and substratum at the bottom. If the eggs are taken in glass pot, they hatch out and grows 12cm. during 3 years and then descends a stream into sea. The forth year adult may be mature. This fish deposits eggs twice or thrice and after the last deposition of eggs it will die. The tired fish descends into sea and takes nutrition for growth. During the period of sea-life, they do not make a group and live in the deeper sea. The spawning is carried out in the sands and pebbles on the bottom of the current waters. The eggs are adhesive. After hatching out the embryos, they make a group in a small pool around the spawning ground, then gradually descends the river into the sea. When they grow up the young of 7-8cm. in body length, they ascend the river during April of the next year and grow very fast. The adult, after spawning, is usually caught by net. To protect the young generation of fish, it is of no use to conserve old fish, as when the adult fish descends the river it will be caught by other fish as food. It is quite difficult a problem to keep an equilbrization between the protection of offsprings and fishing amounts. As for this problem, we must consider the limitation of fishing period, fishing ground and fishing equipments. The author concludes that these limitations may vary to the size and environments of the river, spawning period and spawning ground, enemies, unexpected flood and other natural changes.

1892

NOZAWA, SHUNJIRÔ, 1892: General Aspects of Fish in Hokkaidô. III, Zool. Mag., 4 (48) pp. 383–390. (in Japanese).

The present report consists of 5 sections concerning the fish in Hokkaidô. Here the author extructs all the freshwater fish only.

1. *Oncorhynchus haberi* HILGENDORF (*Oncorhy. keta*): The present species is quite changeable for feature by the different water environment. Sometimes, the body has black patterns and changeable color for the environments. From these reasons, we could not see the same color salmon in two different rivers. The color of flesh is also affected by the kind of food. There are many color and outer-feature variations in Hokkaidô. The salmon migrated into Nemuro Bay, is not so large and has a round trunk. The body color is also found different in each river. The salmon produced in Nishibetsu, is of white silvery belly and bright. The salmon caught in Hyotsû, is not bright. The salmon produced along the Kitami sea, large and dark black, somewhat flatter than that of Muroran. The salmon produced in the east of Mosuso Misaki cape, along the South of Hokkaidô, is larger and broader. The salmon caught in Ôtsu, is somewhat larger than that of Kushiro, and easily distinguishable from others. The salmon from Horoizumi, is golden and it gradually decreases in size towards found south. In the western coast of Hokkaidô, the salmon from Sôya is the largest and nicest of the salmon in Hokkaidô. The distribution and migration of salmon around Japan Sea are mentioned by the author as follows. The salmon migrating near Japan Sea from other waters are divided into two groups, by two different currents. The first group is migrating along the Kurile current and then divides into two. One of the two also divides into two groups on the way to the south to reach Tokachi, Kushiro, and the other descends towards Erimo-misaki and then appears in the east coast of Hidaka

and southward. The second group also divides into two, just before the time of their entering Nemuro Bay. One probably reaches, while the other goes towards Nôtori cape and then near Abashiri Sea and then goes further westward along the Abashiri coast. The group from Sôya sea to the west coast of Hokkaidô, migrates along the Karafuto current. When it arrives Sôya, then it goes further down south to the west coast of Hokkaidô. Here we have a table to show fishing amounts of the two groups of salmon migrating towards Hokkaidô, for the three years (1887–1889).

	1887	*1888*	*1889*
name of districts	*fishing amounts*	*fishing amounts*	*fishing amounts*
Karafuto current Salmon			
Toshima	1.805 (koku = 180 liter)	2.440	1.208
Kunashiri	5.018	8.033	3·634
Ishikari	13.768	16.249	10.769
Teshio	3.274	6.898	3.280
Kitami (Soya)	3.150	4.766	3.338
Total	27.015	38.346	22.256
Kurile Current Salmon			
Kitami	12.953	11.304	12.562
Nemuro	27.405	35.986	59.906
Kushiro	2.890	2.497	3.603
Tokachi	9.480	3.515	9.581
Hidaka	7.788	7.850	15.014
Iburi	3.195	2.647	4.660
Toshima	2.372	1.807	4.636
Small total	66.083	65.606	108.970
Large total	93.098	103.952	131.226

From the above table, the author makes a remark that the Kurile current salmon is more abundant than the Karafuto current salmon, as the area of Kurile current is broader than the Karafuto current. Habits: The salmon spends nearly all of his life in the sea. During summer, it lives in the cold waters of some depth and in autumn it comes up the shallow waters to ascend freshwater rivers. The youngs on being hatched out swim for themselves and descend rivers into the sea to get suitable food. The eggs measures 6 cm. in diameter, in light red. The number of eggs in one female is about 3000 in average, (1000–4000 eggs were counted at Chitose Hatchery of Hokkaidô). In the water temperature of 45°, the eggs usually hatch out is seven weeks. The embryo is absorbed the egg capsule within 12 weeks. When the young attains 1.5 cm. in body length, it cast off into a river. After the absorption of egg capsule, the young is ready to descend the river into the sea. About of the sea life all is not yet certain and when the adult reaches the entrance of a river (the mouth of a tributary), he stays there in for while as he is afraid of changing sea water into freshwater. When he enters into freshwater, he never takes food until he reaches a spawning ground.

1892

NOZAWA, SHUNJIRÔ, 1892: General Aspects of Fish in Hokkaidô. IV. Zool. Mag., 4 (49), pp. 423–429. (in Japanese).

Oncorhynchus perryi HILGENDORF: The author distinguishes *On. perryi* from *On. haberi* for its broader body, smaller head, broader caudal, and smaller deciduous scales. This fish is not ready to change the body color for the environments. The back is dark blue and the belly is silvery. The one which comes up around the long-shore coast, is called "Kuromasu". The one which comes up later (in the cherry blossom season) is called "Sakuramasu". The one which grows to a certain size is called "Se-

goimasu". The one which ascends the river is called "Masu": The fish ascends the river at the beginning of May and spawns during August and September. The method of spawning is not different from *O. haberi* but the spawning period is affected by water temperature. The famous fishing grounds are Etorofu, Kunashiri, Nemuro and Kitami. Recently in Hokkaidô this fish is not caught abundantly as before.

"Benimasu" *Oncorhnchus nerka*: This is mostly produced in Etorofu and Urup islands of the Kurile Islands. Sometimes it migrates into the long-shore coast of Nemuro-sea. When it lives in a lake, it ascends the river of the lake during July and August and spawns in the shallow waters.

"Masunosuke" *Oncorhynchus tschawytscha*: The outer feature looks like "Masu". The body attains 60–90 cm. in length. The scale is not desciduous and a number of fin rays is larger than "Masu". It is caught in a very small number in the east-southern sea of Hokkaidô every spring together with "Masu".

"Amemasu" *Salvelinus leucomaenis*: The fish has a small head and a somewhat pointed snouts bluish white patterns exist on both sides of the body. It is distributed widely in the long sea-coast of Kamtchaka Pen. In the Kurile Islands and the coast of Kitami, Hokkaidô, a few of them are caught. During June and July, it ascends the river to spawn. After the spawning it descends the river into the sea around where it lives nearly all the year. There is no lakes of Hokkaidô where "Amemasu" lives.

"Ito", *Salmo blackistoni* HILGENDORF: This is characteristic for its large head and many black spots on the posterior head and both sides of the body. This is abundant in Karafuto and also found everywhere in Hokkaidô. In spring, it ascends the rivers to spawn. The largest ones in Japan sea attain 120 cm. in body length.

"Yamabe", *Salmo macrostoma* GÜNTHER. "Iwana", *Salmo pluvius* HILGENDORF.: The distinguished characters of the two species mentioned above are found in "Yamabe"; black small spots on the dorsal and ventral sides and large black patterns arranged along the lateral organs in a line. In "Iwana", the red spots are found on both sides of the lateral organs and the pectoral, and ventral fins are red. Both species are distributed in the north of the middle part of Honshû and in every stream of Hokkaidô. Iwana mostly found in upper streams and in the lower ones of the north part of Hokkaidô.

In Kurile, it is found in the sea. "*Kabachepu*" land-rocked *Oncorhynchus nerka.*: This fish is limited in Akan-gun, Kushiro Province, Hokkaidô. It is not so large, mostly within 30 cm. and in summer it ascends the rivers of the lake to spawn.

"Kiuriuwo", *Osmerus epreanus* LACEPEDE. When the meat is fresh, it smells as cucumber. The smell comes from the mucous secreted from the skin. It is abundant in the northeast coast, while in the south it seems to be found in cold currents. In the spring, the fish ascends the rivers Nishibetsu, Kushiro and Tokachi.

"Ayu" *Plecoglossus altivelis* SCHLEGEL. No "Ayu" was thought to be found in Hokkaidô a few years ago, but it is confirmed to exist in the rivers Chinai, Ishizaki, Amanogawa of the southwest coast and the River Ishikari seems to be the north demarcation line in Hokkaidô. The breeding season occurs from September to early October.

"Chika" *Hypomesus olidus* PALLAS: This species is distinguishable from other species by its desciduous scale and a silver band along the lateral line of the body. It is found everywhere and lives along the coast in all seasons. During the spawning season, it ascends the river. The season somehow varies in the south and the north. In the south, the breeding season occurs towards the end of November, while in the east and the north it occurs in spring.

"Irauwo" *Salanx microdon* BLEEKER. The white, delicate, small salmonoid fish is found in south Hokkaidô, Kushiro in east Ishikari to the west.

1893

KITAHARA, TASAKU, 1893: Freshwater Fishes of Gifu Prefecture. Zool. Mag., 5 (62), pp. 465–468. (in Japanese).

The author listed 26 species from the freshwater fish specimens in Gifu Prefecture presented by Mr. NAWA, H. to Professor K. MITSUKURI. Several specimens of the collection were not identified as to the definite species. *Cobitis* sp., *Acheilognathus* sp., *Pseudorasbora parva* var., *Pseudoblemnus* sp., *Gobius* sp.,

are not yet determined by him.

1895

KITAHARA, TASAKU, 1895: Is it a Young of *Plecoglossus altivelis*. Zool. Mag., 7 (86), pp. 426-427. (in Japanese).

The author collected a young fish together with young Salmon, in Bay, Rikuchû Province. This young shows the body height, body length, head length, snout, the situation of eye as in his figure. The fin formula are: B. 7, D. 11-12, A. 17-18, P. 14, V. 8. Adipose fin, scaleless, with minute coned teeth on both jaws. Somewhat larger teeth on tongue and upper branchial bone. Brown small spots on the head and opercles. Another small brown spots exist on the back and median line of belly and lateral sides of body. The semitransparent and looks "Shirauwo". The characters of the fin ray number of each fin and the number of branchial spines and the situation of each fin are quite similar to *Plecoglossus altivelis*. But the proportions of body height, and head lenght are nearly allied to young *Plecoglossus altivelis*. From these characters, the author has some question in the identification with young *Plecoglossus altivelis* or not.

NAWA, HISASHI, 1895: Notes on the Development of *Plecoglossus altivelis*. Zool. Mag. 7 (85), pp. 391-392. (in Japanese).

It is certain that the youngs mostly take small animals and when they grow, they take diatomes. According to NAMIYE, one of the Zoologists of Japan, this fish changes the construction of mouth for the kind of food. A *Plecoglossus altivelis* distributed in Lake Biwa, is extremely small in size, treated a different species of common *Plecoglossus altivelis*. This small one eats the powder of pupae of silkworms when it is angled for in the Serigawa, Hikone. From this fact, the author considers that "Ko-ayu" has no period to take plant food, always taking animal foods for life.

1896

KITAHARA, TASAKU, 1896: Notes on the Salmon in Japan. Zool. Mag., 8 (97), pp. 421-426; 8 (98), pp. 457-463. (in Japanese).

The author found eleven species of Japanese Salmonidae. He made a complete key of this group with brief descriptions.

1897

KITAHARA, TASAKU, 1897: Kabacheppu. Zool. Mag., 9 (110), pp. 485-486. (in Japanese).

The Hokkaidô local government exhibited a trout called "Kabacheppu" feeding in the Chitose Hatchery, Iburi Province, obtained from Lake Akan, Kushiro Province. The specimen is closely allied to *Oncorhynchus nerka*, though it is rather small, about 30 cm. in body length, with dorsal and caudal fins with circular spots. This fish is only found in Lake Akan in Hokkaidô. This is also found in lakes of western coast of North America and not in the rivers. From this fact, the fish may be a land locked form. Dr. GILBERT found them in the Columbia River and Lake Walowa. Dr. JORDAN considered it to be a distinct species. About this trout, very little is known in America and in Japan.

HATTA, SABURO, 1897: Preliminary Note on the Development of the Pronephros in *Petromyzon*. Ann. Zool. Jap.,* 1 (4), pp. 137-140.

The author studies the history of development of the pronephros in *Petromyzon*. He makes a conclusion that this report shows. Both the pronephric tubules and segmental ducts are purely the organs

* Ann. Zool. Jap. = Annotationes Zoologicae Japonenses published by the Zoological Society of Japan at Zoological Institute, Tôkyô University.

of the lateral unsegmented portion of the mesoblast; the somatic mesoblast as well as the other germinal layers have no share in their formation. The anlagen of the tubules follow, from their first appearance, the same segmental arrangement as the mesoblastic somites. The persistent tubules are, therefore, the third, fourth, and fifth ones, of which the third pair have so well developed as the next two. It is an interesting fact that the first and second pairs originate in the region where afterwards the gill-slits are formed, and they disappear when the latter come into view. In later stages, the third or foremost pair of persistent tubules are in close contact with the hind wall of the gill-chamber.

1898

ISHIKAWA, CHIYOMATSU, 1898: On the Variations of the Proportional Lengths of the Head, etc. as to the Total Length in our Common Eel. Ann. Zool. Jap., 2 (3), pp. 125-126.

The author finds out many variations occurring among the individuals of eels in Japan, taken from one and the same locality is very great. He concludes that two species of eels-*Anguilla vulgaris* and *bostoniensis* might be simply the varieties of a single species. From these measurements it will be seen that all the specimens from Tokushima, Shikoku are of the *vulgaris* type. The same is the case with a single specimen taken in the River Asahi in Mimasaku, while coming over to the northern side of the mountain range, we find among 5 specimens from Lake Jinsai, Izumo, 1. *bostoniensis* 2. doubtful specimens standing between the two, and two *vulgaris*. Further east in Tottori, Hôki, the *bostoniensis* type appears, to become less. The *vulgaris* type appears, however, to preponderate more and more, and in Tôkyô, judging from only three specimens kept in the museum, we find more *vulgaris* than *bostoniensis*. The specimens from Hidaka in Hokkaidô, show more *bostoniensis* than *vulgaris*. From these facts, the author concludes about the distribution of the two types of *Anguilla* in Japan that the type *bostoniensis* occurs more in the central portion, *vulgaris* is the predominent type.

1900

ANDÔ, ISAJIRÔ, 1900: Observations on Stickleback. Zool. Mag., 12 (138), pp. 133-126. (in Japanese).

The author observes on the *Gasterosteus aculeata* var. *gymnurus* at Kanochô, Gifu Prefecture. In this district, the species is distributed widely. They are found at Inaba, Motosu, Umizu and Kanochô. He describes nest and egg and supposes that the stickleback spawns one or two times during June and July. He also notes on the variation of spines and scales and swimming method as well as habits.

HATTA, SABURO, 1900: Contributions to the Morphology of Cyclostomata. II. On the Development of Pronephros and Segmental Duct in Petromyzon. Journ. Coll. Scie., Imp. Univ. Tôkyô,* 13 (3), pp. 311-425.

This is a second report on the later stages in the development of *Petromyzon*. The author wants to study the development of Pronephros and Segmental ducts in *Petromyzon*. This report is divided into two sections, the first of which contains descriptions, while in the second is given a historical review and conclusions.

JORDAN, D. S. et SNYDER, J. O., 1900: A List of Fishes collected in Japan by KEINOSUKE OTAKI and by the United States Steamer Albatross, with Descriptions of fourteen new Species. Proc. U. S. Nat. Mus., 23 (1213), pp. 335-380.

They listed 39 species of freshwater fishes in Japan. Many specimens were collected in 1895 and 1896 in the Bay of Tôkyô about Misaki, and in Lake Biwa, by KEINOSUKE OTAKI, former Professor of Imperial Military Academy in Tôkyô. A small collection of fishes from Lake Biwa, sent by late Prof. CHIYOMATSU ISHIKAWA of the Agricultural Department in the Imperial University in Tôkyô;

* Journ. Coll. Scie., Imp. Univ. Tôkyô = Journal of College of Science, Imperial University of Tôkyô published by the Zoological Institute of Tôkyô Imperial University. Tôkyô.

a collection of gobies and other small fishes from the late Prof. K. KISHINOUYE of the Imperial Fisheries Bureau; a few specimens sent by the late Prof. KAKICHI MITSUKURI of the Imperial University of Tôkyô; and a large collection made by the Albatross under the direction of Lieut.-Commander JEFFERSON F. MOSER, U. S. N. in the summer of 1896 are described. This collection was mainly from Shana Bay, Iturup Island, Ushishir Island, Hakodate, and from around Yokohama. The types of the new species were all preserved in the U. S. National Museum Washington. Most of these fishes were marine, and a very few were freshwater fishes.

1. *Lampetra mitsukurii* HATTA, Tôkyô (MITSUKURI). Lake Biwa (ISHIKAWA).
2. *Pseudobagrus aurantiacus* (T. et SCH.). Tôkyô (ÔTAKI).
3. *Parasilurus asotus* (LINNAEUS). Tôkyô, Lake Biwa (ÔTAKI).
4. *Misgurnus anguillicaudatus* (CANTOR). Tôkyô (ÔTAKI).
5. *Cobitis japonica* (T. et SCH.). Lake Biwa (ÔTAKI).
6. *Cyprinus carpio* LINNAEUS. Tôkyô (ÔTAKI).
7. *Carassius auratus* (LINNAEUS). Tôkyô (ÔTAKI).
8. *Hemibarbus barbus* (T. et SCH.). Lake Biwa (ÔTAKI), Tôkyô (Albatross).
9. *Gobio biwae* JORDAN et SNYDER. Prof. CH. ISHIKAWA collected this specimen at Matsubara, Lake Biwa. This species is easily distinguished from *G. mayedae* by its much more elongate body and darker color.
10. *Gobio mayedae* JORDAN et SNYDER. The specific name was dedicated for KINICHIRO MAYEDA, a former student of ichthyology at Stanford University.
11. *Pseudogobio esocinus* (T. et SCH.). Lake Biwa (ÔTAKI).
12. *Sarcocheilichthys variegatus* (T. et SCH.). Lake Biwa (ÔTAKI).
13. *Gnathopogon elongatus* (T. et SCH.). Lake Biwa (ÔTAKI).
14. *Acheilognathus rhombeum* (T. et SCH.). = *A. steenackeri* SAUVAGE. Lake Biwa (ÔTAKI; ISHIKAWA).
15. *Acheilognathus lanceolatum* (T. et SCH.). Lake Biwa (ÔTAKI).
16. *Acheilognathus intermedium* (T. et SCH.). Lake Biwa (ÔTAKI).
17. *Barilius platypus* (T. et SCH.). Lake Biwa (ÔTAKI).
18. *Opsariichthys uncirostris* (T. et SCH.). Lake Biwa (ÔTAKI).
19. *Otakia rasborina* JORDAN et SNYDER. Lake Biwa (ÔTAKI).
20. *Leuciscus hakuensis* GÜNTHER-*Leuciscus hakonensis* ISHIKAWA. Lake Biwa, Tôkyô (ÔTAKI, ISHIKAWA), Hakodate (ALBATROSS). Late Prof. ISHIKAWA suggested the change of *hakuensis* to *hakonensis*, in accordance witth the proper Japanese spelling of Hakone. Such a change is, however, not permisible according to our interpretation of the law of priority.
21. *Ischikauia steenackeri* (SAUVAGE) = *Opsariichthys steenackeri*, Lake Biwa (ÔTAKI).
22. *Oncorhynchus kisutch* (WALBAUM) = *Salmo macrostomus* GÜNTHER. Lake Biwa (ÔTAKI).
23. *Salmo perryi* BREVOORT. Lake Biwa (ISHIKAWA).
24. *Plecoglossus altivelis* (T. et SCH.). Lake Biwa (ÔTAKI).
25. *Aplocheilus latipes* (T. et SCH.). Tôkyô; in streams and rice fields (ÔTAKI).
26. *Pygosteus japonicus* (STEINDACHNER). Nagoya (ÔTAKI).
27. *Gasterosteus cataphractus* PALLAS. Myiako (ÔTAKI).
28. *Odontobutis obscurus* (T. et SCH.). Yokohama (ÔTAKI).
29. *Eleotris oxycephala* (T. et SCH.). Lake Biwa (ÔTAKI).
30. *Acentrogobius gymnauchen* (BLEEKER). Tôkyô (ÔTAKI; KISHINOUYE).
31. *Acentrogobius pelaumi* BLEEKER. Tôkyô (KISHINOUYE).
32. *Aboma lactipes* (HILGENDORF). Tôkyô (ÔTAKI), Tone River (KISHINOUYE).
33. *Chaenogobius castaneus* (O' SHAUGHNESSY). Tôkyô (ÔTAKI), Lake Biwa (ISHIKAWA).
34. *Chaenogobius macrognathus* (BLEEKER). Lake Biwa (ISHIKAWA; KISHINOUYE).
35. *Gobius similis* (GILL) = *Rhinogobius similis* GILL. Ishikawa Prefecture (KISHINOUYE).
36. *Chaeturichthys hexanemus* (BLEEKER). Lake Biwa (ISHIKAWA).
37. *Triaenophorichthys squamistrigatus* (HILGENDORF). Tone River; Ishikawa Prefecture (KISHINOUYE).

38. *Trifissus iotturus* JORDAN et SNYDER. Tôkyô Bay (KISHINOUYE).
39. *Luciogobius guttatus* GILL. Tôkyô (ÔTAKI).

HATTA, SABUBO, 1900: The Species and Distribution of the *Lamprey* in Japan. Zool. Mag., 12 (139), pp. 157–173. (in Japanese)

The author divides the Family Petromyzontidae into four genera. The group shows the first dorsal fin continuous the 2nd dorsal fin. In this A group, three genera *Petromyzon. Ichythomyzon* and *Mordacia* are included. The B group shows the second dorsal fin separated from the caudal fin. It has only one genus *Geotria*. From his observations on the young stage of *Ammocoetus*, the adult is filted for 5 years old after metamorphosis and he could find out the adult characters in the specimens of collection during the breeding season. He discusses on the species found in Japan. The third species belonging to the genus *Petromyzon*, *P. marinus* is not yet discovered in Japan (the author believes that this species may be found in Hokkaidô). This is called Sea Lamprey in English and Lake Lamprey by Americans. It attains 30 cm. in body length and differs from the other two species in color and tooth arrangement; Sea Lamprey has very small number of tooth while the Japanese large Lamprey has one tooth on the upper jaw. This Japanese large Lamprey may be identified with *Petromyzon fluviatilis* L. (the River Aka, Echigo Province; Kosanike, Inaba Province). The middle sized one secured in Gifu and Yamagata Prefectures may be identified with *Lampetra wilderi* GAGE. This specimen is called "Sunayatsume". The distribution of Petromyzon is very wide. It lives in Wakasa, Tanba, Tango, Kii, Iwami, Oki, Nagato, Iki and Tsushima except Yamanashi, Hiuga, Kagoshima Tosa and Okinawa.

1901

HATTA, SABURO, 1901: On the Lampreys of Japan together with Notes on a Specimen of *Lamprey* from Siberia. Annot. Zool. Jap., 1 (1), pp. 21–29.

The author describes the Japanese lamprey and its distribution. The smaller lamprey *Lampetra mitsukurii* is found in almost all localities of Japan, while the larger one, *L. japonica*, is limited to the rivers and ponds on the slope of Honshû facing on the Japan sea; the latter is especially abundant in the Shinano River, the Mogami River, the Omono River, the Jintsu River, Lake Kawakita, and in Kozan Pond.

HAYASHI, HIROSUKE, 1901: Sex of Loach (*Misgurnus anguillicaudatus* (CANTOR). Zool. Mag., 13 (147), p. 27. (in Japanese).

During summer, the author noticed an elevation just behind the dorsal fin of a loach. He has observed the habits of males in paddy field and found the elevation above mentioned only in the males during spring and summer. This character may exhibit a sexual difference between a male and a female.

ISHIKAWA, CHIYOMATSU, 1901: Notes on Two New Species of Fishes from the Lake Biwa. Annot. Zool. Jap., III, 4, pp. 161–164.

The author described two new species of *Leucogobio*. *L. güntheri* was obtained at Matsubara fishmarket, Hikone, Shiga Prefecture in December, 1898 and *L. jordani* was obtained at Shimotsu in the same year and from Matsubara fish market, Shiga Prefecture. The two species were well illustrated and described in this paper.

JORDAN, D. S., 1901: The Fish Fauna of Japan with Observations on the Distribution of Fishes. America Association for the Advancement of Science, Denver Meeting.

The author discusses the distribution of fishes in Japan and makes some remarks on the freshwater fishes. The writer said, "About nine hundred species of fishes are known, from the four great islands of Japan, and about two hundred more from the volcanic islands Kuriles and Liûkiû to the north to south. Of the eleven hundred, about fifty are of freshwater. All of these are derived from the main-

land of Asia. Two faunal districts, the north and the south, may be recognized among the freshwater fishes. The mountain region and the region lying to the north of Fuji abound in trout, with salmon, sturgeon, lamprey, and northern fishes. In the southern district these are absent, and the chief freshwater fishes are "Ayu", or dwarf Salmon Chubs, Minnows, Cat-fishes and Loaches.

JORDAN, D. S., and **SNYDER, J. O.,** 1901: Descriptions of Nine New Species of Fishes contained in Museums of Japan. Jour. Coll. Scie. Imp. Univ. Tôkyô, 15 (2), pp. 301-311.

In this report a new species *Acipenser kikuchii* JORDAN and SNYDER was described. It was taken in the open sea in a net in the deep water off Misaki, Sagami Bay, Province of Sagami, Japan. This sturgeon is distinguished from most other sturgeons by the very long dorsal fin.

JORDAN, D. S., 1901: The Fish Fauna of Japan, with Observations on the Geographical Distribution of fishes. Science (2), 16, pp. 545-567, New York.

The author mentioned the distribution of freshwater fishes of Japan and divided the distributional districts into two. The northern district includes Hokkaidô and the northern and middle parts of Honshû. The southern limit of this district is lined with Mt. Fuji and Matsushima Bay. The characteristic fishes are Acipenser, Salmon, Trout, Salanx, Eel and Spined stickleback. The southern district occupies the south of Honshû, Shikoku, and Kyûshû. This is characterized with the distribution of Hymenophysa, Gnathopogon, Tribolodon and Acheilognathus. The author also mentioned the origin of the freshwater fishes of Japan. He thought that the origin was rather simple and all of the representative forms were orignated from the Asiatic Continent. One of the widely distributed species is Tribolodon which is found in freshwater and sea. *Leuciscus jouyi* is still found around the sea of Tsushima, one of the small islands between Japan and Korea.

JORDAN, D. S. and **SNYDER, J. O.,** 1901: A Review of the Lancelets, Hag-fishes, and Lampreys of Japan, with a Description of Two New Species. Proc. U. S. Nat. Mus., 23 (1233), pp. 725-734.

The authors described lancelets, hag-fishes, and lampreys, known to inhabit the waters of Japan. The specimens were collected by them in Japan, in the summer of 1900 and were deposited in the U. S. National Museum. Here we have mentioned only the specimens related to freshwater fishes.

1. *Lampetra japonica* (Von MARTENS). The specimens were obtained from Shinano River in Echigo, near Tôkyô and Noshiro. They are generally common in rivers of Honshû, north to about Niigata and Miyagi Prefectures.

2. *Lampetra mitsukurii* (HATTA). The eight specimens obtained from the Ishikari River, Hokkaidô. It is distributed in rivers of Hokkaidô, and Honshû, north of Miyagi and Niigata Prefectures.

JORDAN, D. S. and **SNYDER, J. O.,** 1901: List of Fishes collected in 1883 and 1885 by PIERRE LOUIS JOUY and preserved in the United States National Museum, with Descriptions of Six new Species. Proc. U. S. Nat. Mus., 23 (1235), pp. 739-769.

The specimens, which the authors mentioned in this report, were collected from the fish markets of Yokohama by the late PIERRE LOUIS JOUY, an assistant of the U. S. National Museum when he visited Japan during 1883. He also collected specimens at Sasuna, the port of the Japanese Island of Tsushima, in the Straits of Korea, during 1885. The author described 10 species of freshwater fishes in the present report.

1. *Carassius auratus* (LINNAEUS). Oide, near Sendai, in Rikuzen. Common in all streams of middle and southern Japan.

2. *Leuciscus hakuensis* (GÜNTHER). Lake near Oide, near Sendai.

3. *Leuciscus jouyi* JORDAN and SNYDER. Tsushima Island. The authors mentioned that the collector did not state whether the specimen was found in salt or freshwater, since the island of Tsushima is said to contain only 262 square miles about one-third of which is cut off from the larger part by a narrow channel. *Leuciscus hakuensis* is able to live in salt water, the authors having found it in tidal pools and offshore at several points along the coast of Japan.

4. *Acheilognathus lanceolatum* (SCHLEGEL). Lake near Oide. A single specimen of the species similar to a common northern Japan species which may not be different from *A. lanceolatum*.

5. *Anguilla japonica* SCHLEGEL. This is exceedingly common in all fresh and brackish waters of Japan.

6. *Salmo macrostomus* GÜNTHER. Lake Chûzenji, Ibaraki Prefecture.

7. *Plecoglossus altivelis* SCHLEGEL. Numata; Sasuna; Tsushima.

8. *Ctenogobius similts* (GILL) = *Rhinogobius similis* GILL. = *Gobius yokohamae* GÜNTHER. Tôkyô; Lake Biwa; Tsushima; Aomori; Shikoku Iyo; Kurume; Kawatana; Nagasaki.

9. *Aboma tsushimae* JORDAN et SNYDER. Sasuna, Tsushima.

10. *Acanthogobius flavimanus* (SCHLEGEL). Yokohama; Tsushima.

11. *Chaeturichthys stigmatias* RICHARDSON. Sasuna, Tsushima.

JORDAN, D. S. and SNYDER, J. O., 1901: A Preliminary Check List of the Fishes of Japan. Annot. Zool. Japon., 3 (2-3), pp. 31-159.

The authors listed 686 species of Japanese fish. The specimens were collected at Lake Biwa by Prof. ÔTAKI in 1896; by the Albatross in the harbor of Hakodate and the harbor of Yokohama and Tôkyô, by the late Prof. CH. ISHIKAWA from Lake Biwa, and by Dr. K. KISHINOUYE of the Imperial Fisheries Bureau at Tôkyô. They have discussed the Japanese fish fauna and divided Japan into 3 districts on the basis of their natural horizontal distribution.

1. Yezo Group …… Northern fishes, having their center of distribution about Hakodate.
2. Nippon Group …… Temperate fishes, having their center of distribution about Yokohama.
3. Kyûshû Group …… Semitropical fishes, having their center of distribution about Nagasaki.

Here we have listed only the freshwater fishes.

1. *Petromyzon japonicus* VON MARTENS. Echigo; Yokohama.
2. *Acipenser mikadoi* HILGENDORF. Yezo; Yokohama.
3. *Liobagrus reini* HILGENDORF. South Japan.
4. *Pseudobagrus nudiceps* SAUVAGE. Lake Biwa.
5. *Pseudobagrus fulvidraco* (RICHARDSON). Japan.
6. *Psudobagrus aurantiacus* (T. et SCH.). Yokohama; Kyûshû. Satsuma; Kurume; Higo.
7. *Pseudobagrus ransonnetii* STEINDACHNER. Ôsaka.
8. *Pseudobagrus tokiensis* DÖDERLEIN. Yokohama.
9. *Parasilurus asotus* (LINN.). Yokohama; Lake Biwa; Higo; Satuma; Nagasaki.
10. *Misgurnus anguillicaudatus* (CANTOR). Nagasaki; Tôkyô.
11. *Misgurnus polynemus* BLEEKER. Yokohama.
12. *Cobitis japonica* TEMMINCK et SCHLEGEL. Lake Biwa; Ôtsu; Matsubara.
13. *Botia curta* (T. et SCH.). Nagasaki; Lake Biwa; Yodogawa; Setagawa.
14. *Cyprinus carpio* (LINNAEUS). Kyûshû; Yokohama; Ôtsu.
15. *Carassius auratus* (LINNAEUS). Yokohama; Ôtsu, Nagasaki; Matsubara.
16. *Hemibarbus barbus* (T. et SCH.). Nagahama; Ôsaka; Yokohama; Tôkyô.
17. *Gobio biwae* JORDAN et SNYDER. Lake Biwa.
18. *Gobio mayedae* JORDAN et SNYDER. Lake Biwa.
19. *Pseudogobio esocinus* (T. et SCH.). Lake Biwa; Matsubara; Tôkyô.
20. *Pseudogobio zezera* ISHIKAWA. Otsu; Maebara; Matsubara; Lake Biwa.
21. *Sarcocheilichthys variegatus* (T. et SCH.). Ôtsu; Matsubara; Maebara; Lake Biwa.
22. *Gnathopogon gracilis* (T. et SCH.). near Nagasaki.
23. *Gnathopogon elongatus* (T. et SCH.). Lake Biwa; Nagasaki.
24. *Acheilognatus lanceolatum* (T. et SCH.). near Nagasaki; Lake Biwa.
25. *Acheilognathus limbatum* (T. et SCH.). near Nagasaki.
26. *Acheilognathus intermedium* (SCHLEGEL). Lake Biwa; Bizen; Matsubara.
27. *Acheilognathus rhombeum* (T. et SCH.). Yokohama; Lake Biwa.
28. *Barilius platypus* (T. et SCH.). Hakone; Ôtsu; Lake Biwa.

29. *Barilius temmincki* (T. et SCH.). Hakone; Ôtsu; Lake Biwa.
30. *Barilius sieboldi* (T. et SCH.). Nagasaki.
31. *Pseudorasbora parya* (T. et SCH.). Lake Biwa; Ôtsu; Maebara; Matsubara.
32. *Otakia rasborina* JORDAN et SNYDER. Lake Biwa.
33. *Leuciscus hakuensis* (GÜNTHER). Ôtsu; Lake Hakone; Hakodate; Yokohama; Lake Biwa; through Japan.
34. *Leuciscus caerulescens* (SAUVAGE). Lake Biwa.
35. *Leuciscus japoncus* (SAUVAGE). Lake Biwa.
36. *Leuciscus steindachneri* (SAUVAGE). Lake Biwa.
37. *Pseudoperilampus typus* BLEEKER. Yokohama.
38. *Tribolodon punctatus* (SAUVAGE). Lake Biwa.
39. *Ischikauia steenackeri* (SAUVAGE). Lake Biwa; Yamato.
40. *Oncorhynchus nerka* (WALBAUM). North Japan.
41. *Oncorhynchus tschawytscha* (WALBAUM). North Nippon; Yeso; Hakodate.
42. *Oncorhynchus macrostomns* (GÜNTHER). Hakodate; Lake Biwa.
43. *Oncorhynchus blackistoni* (HILGENDORF). Rivers of Japan.
44. *Salmo perryi* (BREVOORT). Hakodate; Lake Biwa.
45. *Salvelinus pluvius* (HILGENDORF). Mount Nikkô.
46. *Salvelinus kundsha* (WALBAUM). Hakodate.
47. *Plecoglossus altivelis* (T. et SCH.). Matsubara; Maebara; Lake Biwa.
48. *Aplocheilus latipes* (T. et SCH.). Yokohama.
49. *Fundulichthys virescens* (T. et SCH.). streams of Nagasaki.
50. *Gasterosteus japonicus* STEINDACHNER. Yokohama.
51. *Eleotris oxycephale* (T. et SCH.). Lake Biwa; Kurimoto; Nagasaki.
52. *Gobius similis* (GILL). Ishikawa Prefecture.
53. *Chaenogobius brunneus* (T. et SCH.). Nagasaki.
54. *Chaenogobius annularis* GILL. Japan.
55. *Aboma lactipes* (HILGENDORF). Tone River; Yokohama.
56. *Aboma heptacantha* (HILGENDORF). near Yokohama.
57. *Aboma urotaenia* (HILGENDORF). near Tôkyô.
58. *Acanthogobius flavimanus* (T. et SCH.). Nagasaki; Yokohama.
59. *Tridentiger obscurus* (T. et SCH.). Nagasaki.
60. *Luciogobius guttatus* GILL. Yokohama.
61. *Leucopsarion petersi* HILGENDORF. streams of South Japan.
62. *Platichthys stellatus* (PALLAS). Yeso.

JORDAN, D. S. and **SNYDER, J. O.**, 1901: A Review of the Gobioid Fishes of Japan, with Descriptions of Twenty-one New Species. Proc. U. S. Nat. Mus, 24 (1244), pp. 33-132, figs. 1-33.

The authors revised the list of the Japanese gobioid fishes. Most of the specimens were collected by them in Japan in the summer of 1900, and numerous other specimens were presented by the Imperial University of Tôkyô through the late Prof. KAKICHI MITSUKURI and by the Imperial Museum of Japan through the late Prof. CHIYOMATSU ISHIKAWA. Other specimens were collected by the U. S. Fish Commission steamer Albatross in 1900 and by the late Prof. KEINOSUKE OTAKI in 1895 and 1896 as well as by Mr. PIERRE LOUIS JOUY in 1885.

1. *Odontobutis obscurus* (SCHLEGEL). Tôkyô Bay; Lake Biwa; Chikugo River, Kurume; Kawatana, Kyûshû.
2. *Eleotris oxycephala* (SCHLEGEL). Haneda; Yokohama; Lake Biwa.
3. *Ctenogobius similis* (GILL). Matsubara, Lake Biwa; Ishikawa Prefecture; Tsushima; Nagasaki; Kurume; Kaga, Kana River; Kawatana; Iyo.
4. *Ctenogobius abei* JORDAN et SNYDER. Wakanoura, Kii. The present species is named for Mr. KAKICHI ABE, of Tôkyô, a former student of Stanford University who accompained the authors in their travels throughout southern Japan.

5. *Ctenogobius similis* (GILL). This is very common in the freshwaters of Japan from above Tôkyô southward, excessively abundant in Lake Biwa. It is one of the smallest gobies, being mature at 2 to 4 inches. The specimens on hand were from Ishikawa Prefecture, Lake Biwa, Tsushima, Nagasaki, Kurume, Kaga, Kana River, Kawatana, and Iyo.

6. *Aboma lactipes* (HILGENDORF). The species is generally common in the days of Honshû. The specimens were from Matushima, Aomori, Tôkyô, Tsuruga, Enoshima and Tone River, near Tôkyô.

7. *Glossogobius brunneus* (SCHLEGEL). These large gobies are common in the streams and estuaries of southern Japan. The specimens were collected from Hakodate, Onomichi, Kurume, Nagasaki and Wakanoura.

8. *Chaenogobius macrognathos* (BLEEKER). The present species is widely distributed in Japan, living in rivers, and is but little less abundant than *Ctenogobius similis*. The specimens were obtained from Funaki, Ômi; Kurume; Aomori; Tôkyô; Tsuruga; Chitose; Matsubara, Shiga; Same, Aomori; Gifu; Mino; Nagoya; Owari; Kawatana, Kyûshû.

9. *Acanthogobius flavimanus* (SCHLEGEL). The present specimen was collected at Wakanoura, Kii. The species is very abundant in all sluggish rivers and estuaries in Japan. The other specimens were obtained at Hakodate; Onomichi; Kurume; Nagasaki; Wakanoura; Misaki; Matsushima; Aomori; Tôkyô; Tsuruga; Enoshima; Niigata and Yodo River, near Ôsaka.

10. *Tridentiger obscurus* (SCHLEGEL). This species is very abundant in the river mouths and estuaries throughout the southern part of Japan. The specimens were collected at Enoshima; Tsuruga; Aomori; Matsushima; Kawatana; Kôbe; Kurume; Nagasaki; Misaki; Wakanoura; Same; Niigata, Tone River near Tôkyô, and Ishikawa Prefecture.

11. *Eutaeniichthys gilli* JORDAN et SNYDER. The specimen was collected from the Tone River, near Tôkyô.

JORDAN, D. S. et SNYDER, J. O., 1901: A Review of the Apodal Fishes or Eels of Japan, with Descriptions of nineteen new Species. Proc. U. S. Nat. Mus., 23 (1239), pp. 837-890, figs. 1-22.

Most of the specimens of the apodal fishes described in this paper are marine. Only one freshwater fish, *Anguilla japonica* SCHLEGEL was described. The specimens were collected from Hakodate, Aomori, Same, Matsushima, Sendai, Tôkyô, Misaki, Wakanoura, Ômura Bay, Kurume, and Nagasaki. In southern very large specimens, 4 or 5 feet long, are sometimes taken. The species is very similar to the American eel (*Anguilla chryspa* RAFINESQUE), differing in that it has a very slightly more anterior dorsal and more blackish edging to the fish behind, matters of very slight importance.

KISHINOUYE, KAMAKICHI, 1901: New Species of *Salangichthys* found in Ariake Sea. Zool. Mag., 13 (157), pp. 359-360. (in Japanese).

He was given an adult specimen of *Salangichthys* from the Fisheries Experimental Station of Fukuoka, Kyûshû. This specimen was obtained at Takahase off Saikai Village, Yamakado-gun, Fukuoka Prefecture by Mr. KAMESABURO, TOYAMA. It was measured 16 cm, colorless, transparent, fin ray of dorsal fin 13, of anal fin 24, of pectoral fin 9, of ventral fin 7. The present species is different from other three species hitherto known Japan (*Salanx microdon*, *S. chinensis*, *S. hyalocranius*) in the less number of the fin rays.

1902

HATTORI, SUTETARO, 1902: Fish in Hotspring. Zool. Mag., 14 (161), pp. 112-113. (in Japanese).

It is well-known phenomena which occurred in the Beppu district, Hayami-gun, Bungo, Kyûshû that *Oryzias latipes*, *Carassius auratus* and *Misgurnus anguillicaudatus* were found in the hotsprings of high water temperature arranging 100° Fahlenheit. Many visitors wonder at this fact except the local people. Here is a very interesting story of an American doctor who came to Beppu Hot Spring and much surprised to find the fish swimming alive in hotspring. He wondered that such phenomena would not occur in his country and considered that the fish has a peculiar construction adaptable to

high water temperature. He dissected the fish but could not find out any characteristic constitution and then put them in a dish and boiled on fire to know how they would change the taste. After that, he opened the lid of the pot to examine and found the fishes were swimming in the pot.

JORDAN, D. S., 1902: The Salmon and Trout of Japan. Ann. Zool. Japon., 4 (2), pp. 69–75.

The author described 10 species of the Salmonidae found in the waters of Japan. The specimens were collected in the waters of Japan, in the summer of 1900.

1. *Oncorhynchus yessoensis* HILGENDORF. The author described that the present species is found only in Japan. It reaches weight of about 8 pounds. The specimens are obtained from Ishikari River and from Aomori.

2. *Oncorhynchus kisutch* WALBAUM. This is common in the rivers of Northern Japan. The specimens were obtained from Otaru, Aomori, Osatsube and Ura River.

3. *Oncorhynchus nerka* (WALBAUM). In Japan it is said to be known only in Kushiro in Northern Hokkaidô, where dwarf examples enter Lake Akan.

4. *Salmo perryi* BREVOORT. The specimens were found in Lake Chuzenji, Kinu River at Utsunomiya, Daiya River at Nikkô, Otani River near Nikkô, Maebara and Karasaki on Lake Biwa, Kawajiri, in Rikuchû, Kitakami River, Aomori, Hakodate, and the fish market of Tôkyô.

5. *Hucho blackistoni* (HILGENDORF). The author mentioned that the present species is found in mountain streams of the north where it said to reach a length of 2½ feet. The specimens were from Kushiro, Nemuro, Chishima, Settsu and from Heigun River in Rikuchû.

6. *Salvelinus pluvius* (HILGENDORF). The specimens were collected from Lake Chûzenji, Ôhata River at Aomori, and Kawajiri in Rikuchû.

7. *Salvelinus kundscha* (PALLAS). The specimens are from Nemuro, Hokkaidô. BREVOORT records it from Hakodate.

8. *Plecoglossus altivelis* SCHLEGEL. This is found in all the rivers of Japan throught the four main islands. The specimens were collected from Same, Ishikari River, Aomori, Matsushima, Tôkyô, Nikkô, Morioka, Sendai, Gifu, Lake Biwa, Wakanoura, Kôbe, Hiroshima, Ôsaka, Kurume, and Nagasaki.

JORDAN, D. S. and **FOWLER, H. W.,** 1902: Notes on little known Japanese Fishes with Description of a new Species *Aboma*. Proc. U. S. Nat. Mus., 25 (1298), pp. 573–576, fig. 1.

The authors made new additions to the Japanese fishes previously described, in which a few freshwater fishes were included.

1. *Anguilla japonica* SCHLEGEL :– Two small specimens were collected at the Yodo River, Ôsaka.
2. *Spheroides ocellatus* (OSBECK) :– A specimen was obtained at the Yodo River, Ôsaka.
3. *Odontobutis obscurus* (SCHLEGEL) :– This was collected from Yogo Lake, Shiga, Prefecture.
4. *Aboma snyderi* JORDAN et FOWLER : – This species was established by four specimens collected from a small pond located in Aomori Prefecture. The type specimen is preserved in the Stanford University, (Specimen no. 7193) and cotypes in the National Museum at Washington. The species name is dedicated to Dr. SNYDER, J.O. a curator of fish, Stanford University.
5. *Chaenogobius macrognathus* (BLEEKER) :– The specimen was obtained at the Yodo River, Ôsaka.
6. *Tridentiger obscurus* (SCHLEGEL) :– Two large specimens were collected from the Kitakami, Iwate Prefecture.
7. *Tridentiger bucco* JORDAN et SNYDER : – The specimen was collected from the Tama River near Tachikawa, Tôkyô.

JORDAN, D. S. and **SNYDER, J. O.,** 1902 : A Review of the Salmonoid Fishes of Japan. Proc. U. S. Nat. Mus., 24 (1265), pp. 567–593, figs. 1–5.

The authors described and catalogued the Salmonidae, Argentinidae and Salangidae from the waters of Japan. The specimens were collected by the authors in 1900 and preserved in the Museum of Leland Stanford Junior University and in the United States National Museum.

1. *Oncorhynchus masou* (BREVOORT). The specimens were collected from Aomori; the Ishikari River at Sapporo, Hokkaidô; and the Daiya River at Nikkô.

2. *Oncorhynchus keta* (WALBAUM). The specimen was collected from Puget Sound, but the figure of their paper was taken from an old male from Hakodate, Hokkaidô. The flesh in this species is pale and pasty, unfit for canning purposes, and in all respects less valuable than that of any of the other species of *Oncorhynchus*. The introduction of better species to the Japanese rivers is a matter of great economic importance.

3. *Oncorhynchus kisutch* (WALBAUM). The authors mentioned that the species is abundant from San Francisco northward, especially in Puget Sound and the Alaskan fjords, and south on the Asiatic coasts to Japan. The specimens were collected from Otaru, the Ura River; Osatsubo, Hokkaidô; and the Aomori fish market.

4. *Oncorhynchus nerka* (WALBAUM). Most of the specimens were collected from Lake Akan, Hokkaidô.

5. *Salmo perryi* BREVOORT. This is distributed in clear waters throughout Honshû and Hokkaidô. This brook trout is known as "Yamabe" or "Yomomi." In the large rivers, as the Kitakami, it reaches a weight of 8 or 10 pounds. The parr marks disappear and the coloration is more silvery. The specimen of the Hokkaidô water descend to the sea. In the small fish the teeth on the shaft of the vomer are about 12 in number in a long double series. As the fish grows larger, the vomerine teeth are lost, until in the adult only about 4 teeth are present. These large fishes are called "Masu" or Salmon by the fishermen. The dark spots very much with individuals, but apparently not with age, some being profusely spotted, others taken at the same time are almost immaculate. The specimens were collected from Aomori; Niigata; Laka Chuzenji; the Kinu River at Utsunomiya; the Daiya River at Nikkô; the Ôtani River near Nikkô; Kamihana in Ômi; Maebara on Lake Biwa; and Kawagiri in southwestern Rikuchû, on a tributary of the Kitakami. The specific name is dedicated to Commandore PERRY.

6. *Hucho blackistoni* (HILGENDORF). This is named for Captain BLACKISTON, author of a treatise on the avifauna of Japan, whose interest in Natural History was largely responsible for the growth of the Musum of Hakodate (JORDAN et SNYDER). The specimens were collected from Kushiro, Nemuro; the Shifto River in Hokkaidô; and from the Heigan River in Rikuchû, near Morioka, Honshû.

7. *Salvelinus kundscha* (PALLAS). This species is very common in the streams of Kamchatka and is occasionally found in northerm Japan. One specimen was collected from Nemuro in Hokkaidô.

8. *Salvelinus pluvius* HILGENDORF. The specimens were collected from Lake Chuzenji, near Nikkô (introduced); Chishima; Nemuro; the Ohata River at Aomori; and Kawagiri in Rikuchû.

9. *Plecoglossus altivelis* SCHLEGEL. This is rather common in the waters of Japan. The specimens were collected from the Ishikari River; Niigata; Aomori; Same; Matsushima; Sendai; Morioka; Tôkyô; the Tamagawa River at Tachikawa; the Daiya River at Nikkô; Gifu; Lake Biwa; Ôsaka; Wakanoura; Kôbe; Hiroshima; Kurume; and Nagasaki. At Gifu and Tachikawa, tamed cormorants are largely used in the capture of the "*Ayu*", which is the most delicious of all Japanese food fishes (JORDAN et SNYDER).

10. *Osmerus dentex* STEINDACHNER. This species is distributed from the coast of Alaska south to Manchuria and northern Japan, abundant northward. The specimens were from Kushiro, Hakodate and the market of Tôkyô.

11. *Mesopus olidus* (PALLAS). This is common in northen Japan. The specimens were from Aomori, Same, and Matsushima.

12. *Mesopus japonicus* BREVOORT. The authors have two specimens of the present species, the one from Kushiro, and the other from Aomori.

JORDAN, D. S. and **STARKS, E. CH.**, 1902: A Review of the Hemibranchiate Fishes of Japan. Proc. U. S. Nat. Mus., 36 (1308), pp. 57–73, figs. 1–3.

The authors described the Hemibranchiate fishes known to inhabit the waters of Japan. The specimens were collected by JORDAN and SNYDER in the summer of 1900.

1. *Gasterosteus cataphractus* (PALLAS). The specimen described by the authors, was collected from Ugo, northwest Japan. The other specimens were obtained from Kushiro and northern Japan.
2. *Pygosteus steindachneri* JORDAN et SNYDER. Numerous specimens were taken from a pond at Inokashira, Musashi, near Tôkyô and from Aomori as well as from Yamashiro.
3. *Pygosteus undecimalis* JORDAN and STARKS. The type specimen collected at Chitose in Hokkaidô by Mr. SH. NOZAWA, was preserved in Leland Stanford Junior University Museum.

OUYE, UICHI, 1902: Freshwater Fish of Harima Province (the Recent Hyôgo Prefecture), Zool. Mag., 14 (167), pp. 341–343. (in Japanese).

The author listed the freshwater fishes of Harima Province.

1. "Sunayatsume" *Lampetra reisnei* (common).
2. "Gigi" *Pelteobagrus nudiceps* (common).
3. "Mikuwo" ? (common).
4. "Dojo" *Misgurnus anguillicaudatus* (common).
5. "Akahimedojo" ? (Kashimamura).
6. "Shimadojo" *Cobitis biwae* (Ibo River).
7. "Koi" *Cyprinus carpio* (common).
8. "Funa" *Carassius auratus* (common).
9. "Nigoi" *Hemibarbus barbus* (common).
10. "Kamatsuka" *Pesudogobio esocinus* (common).
11. "Mugitsuki" *Pungtungia herzi* (common).
12. "Tanago" *Acheilognathus moriokae* (common).
13. "Oikawa" *Zacco platypus* (common).
14. "Kawamutsu" *Zaco temmincki* (common).
15. "Moroko" *Gnathopogon elongatus elongatus* (Ibo River, Ichi River).
16. "Gotohaye" ? (Ibo River, Shiso-gun).
17. "Ida" Young of *T. hakuensis* (Ibo River).
18. "Ugui" *Tribolodon hakuensis*.
19. "Zenitanabira" *Acheilognathus tabira* ?
20. "Unagi" *Anguilla japonica* (common).
21. "Masu" *Oncorhynchus masou* (Shiso-gun).
22. "Yamabe" *O. macrastoma* (Kôte mura, Shiso-gun).
23. "Ayu" *Plecglossus altivelis* (Kako River, Ibo River, Ako River).
24. "Hirabe" ? (Shiso-gun).
25. "Medaka" *Aplocheilus latipes* (common).
26. "Togeuwo" *Gasterosteus aculeatus* ? (Ichi River, Kanazaki-gun).
27. "Menada" *Mugil cephalus* (Ibo River).
28. "Yotsume" *Lateolabrax japonicus* ? (Iso River, Amuchi River, Shiso-gun).
29. "Kazika" *Cottus pollux* (common).
30. "Tochingo" ? (common).
31. "Kawagisu" ? (Ichi River).
32. Dobozu" *Gobius* ? (common)
33. "Kawahaze" *Gobius* ? (common)

He added some other notes on the freshwater fishes of this district.

YOSHIZAWA, SHOSAKU, 1902: Notes on Stickleback. Zool. Mag., 14 (160), pp. 59–61. (in Japanese).

He observes *Gasterosteus pungitius* in a stream along the sea-coast of Shinkawa-gun, Toyama Prefecture. His description is rather brief and not needed to describe here again.

1903

HAYASHI, HIROSUKE, 1903: Notes on *Misgurnus anguillicaudatus*. Zool. Mag., 15 (181), pp. 410–424. (in Japanese).

The author mentions a general idea on Japanese loaches (*Misgurnus anguillicaudatus*). He describes that this fish is common in Japan, mostly found in paddy fields, ponds and swamps. The body is cylindrical and the scale is very minute. Generally, it takes worms or *Chilo simplex* BUTLER around paddy fields. It is ordinarily about 15–18 cm. in length and 26–30 g. but some were weighed 296 g. which were obtained in a swamp at Chosei-gun, Kusa Province (Chiba Prefecture). It respires in the water and sometimes swimming up to the surface to respire the air. About five times in 30 minuts respires a larger loach and about 18 times a smaller one. When it lives in paddy fields, it does not migrate so widely but when a heavy rain increases the water it ascends the river to reach the upper stream. After taking a large amount of food during summer it buries itself in mud toward winter. In the spring, when it becomes warmer, it appears suddenly from the bottom. This fish is active and if on

land it never dies in so short a time. The male has a long and pointed pectoral fin and has a swelling behind the dorsal fin on both sides.

The female has somewhat shorter and rounded pectoral fin.

The sex ratio is not yet unknown.

The production of loach in the small district of Chiba Prefecture

In 1901	Fishing amounts	54120.........18040,000 individuals.	one individual weight 9g. (in average).
1892		88555.........29518,000 individuals.	one individual weight 9g. (in average).

JORDAN, D. S. and FOWLER, H. W., 1903: A Review of the Cyprinoid Fishes of Japan. Proc. U. S. Nat. Mus., 26 (1334), pp. 811–862, figs. 1–8.

The authors described the specimens of Cyprinoid fishes collected by Prof. JORDAN and SNYDER during 1900, and known to inhabit the rivers and lakes of Japan. This group comprised nearly all of the Japanese fresh-water fishes, but probably numerous species in the rivers of Kyûshû yet remain undescribed.

1. *Pseudoperilampus typus* BLEEKER. This is generally common in the streams of northern Japan. The specimens were collected from Tsuruga in Echizen, Tsuchiura near Tôkyô, Matsushima in Rikuzen, and the Tôkyô market.

2. *Paracheilognathus rhombea* (SCHLEGEL). The authors described the species from specimens from Lake Biwa at Matsubara, the Yodo River at Ôsaka, the Chikugo River at Kurume, the springs of Funayado in Kyûshû, Lake Yogo near Wakanogo above Lake Biwa, and several examples from the collection of K. OTAKI from near Karasaki on Lake Biwa. This is the largest minnow of its tribe and is common in almost all the larger streams and ponds south of Tôkyô.

3. *Acheilognathus limbata* (SCHLEGEL). The specimens were collected from Lake Biwa at Matsubara and Karasaki, the river at Tsuchiura, the Iwai River at Ichinoseki, near Nagoya, and the Kitakami River at Morioka.

4. *Acheilognathus lanceolata* (SCHLEGEL). The authors described the species from an example from Tsuchiura. This species is very abundant in central and southern Japan. The specimens were collected from Tsuchiura, the Chikugo River at Kurume, the Yodo River at Ôsaka, Lake Biwa at Matsubara, Katata in Ômi, Lake Yogo in Mino, Funayado in Kyûshû, Wakanoura, and Owari near Nagoya.

5. *Acheilognathus cyanostigma* JORDAN et FOWLER. The present new species was established on the specimen collected at Matsubara, on Lake Biwa. This species was also found in Lake Yogo in Mino.

6. *Gnathopogon elongatus* (SCHLEGEL). Of the specimens, one 3 inches and an other $3\frac{1}{2}$ inches in length were taken in some stream near Nagasaki, and the other specimen was taken by Mr. OTAKI at Karasaki on Lake Biwa.

7. *Gnathopogon gracilis* (SCHLEGEL). From a stream near Nagasaki.

8. *Hemibarbus barbus* (SCHLEGEL). From the Yodo River at Ôsaka, Lake Jinsaburogata at Nishitsugaru in Aomori, the Chikugo River at Kurume, and from near Tôkyô (Albatross collection).

9. *Leucogobio günther* ISHIKAWA. Taken at Matsubara, Lake Biwa; Nagoya in Owari; Katata in Ômi; and from the Chikugo River at Kurume.

10. *Leucogobio jordani* ISHIKAWA. From Shiwotsu and Matsubara on Lake Biwa.

11. *Leucogobio mayedae* (JORDAN et SNYDER). This is very abundant in Lake Biwa. The specimens were collected from Lake Biwa at Matsubara and Zeze, the Yodo River at Ôsaka in Settsu, the Chikugo River at Kurume, and from near Nagoya in Owari.

12. *Leucogobio biwae* (JORDAN et SNYDER). The type specimen was taken by the collectors of the Ichthyological collections, Leland Stanford Junior University Museum, from Lake Biwa, near Matsubara.

13. *Pseugobio esocinus* (SCHLEGEL). The specimens were collected from Lake Biwa at Matsubara, the Kitakami River at Kurume, Tsuruga in Echizen, the Yodo River in Ôsaka, Kawatana in Hizen,

the Iwai River at Ichinoseki, the Kaminutani River in Ômi, and from Karasaki on Lake Biwa. It is one of the commonest of Japanese fishes and it found lying on the river bottoms among the rocks or weeds.

14. *Sarcocheilichthys variegatus* (SCHLEGEL). The specimens were collected from Matsubara, Lake Biwa; the Yodo River at Ôsaka in Settsu; the Chikugo River at Kurume in Chikugo; Lake Yogo near Ôtsu; Funayado in Kyûshû; Tsuchiura, and Tôkyô. As specimens of this species grow older, the lateral band on the caudal becomes more indistinct. During the breeding season the snout of the male becomes covered with pearl organs.

15. *Abottina psegma* JORDAN et SNYDER. The present species is based on the specimen collected from the Chikugo River, at Kurume, and the Iwai River, at Ichinoseki in Rikuchû.

16. *Zezera hilgendorfi* (ISHIKAWA). Two specimens were collected; one from Funayado in Kyûshû, the other from the Kamo River in Yamashiro. The type specimen was collected from the Ahasi River in Mimasaku.

17. *Biwia zezera* (ISHIKAWA). The specimen described was from the Yodo River at Ôsaka, while the type specimen originally described by Prof. CHIYOMATSU ISHIKAWA was from the Ahasi River at Mimasaku.

18. *Pseudorasbora parva* (SCHLEGEL). This minnow is very common in Japan. The specimens were collected from Tsuchiura, near Mito; Lake Yogo near Nakanogo in Mino; Lake Biwa at Matsubara; the Iwai River at Ichinoseki; the Chikugo River at Kurume, the Yodo River at Ôsaka, and Karasaki at Lake Biwa.

19. *Otakia rasborina* JORDAN et SNYDER. The type specimen was collected at Karasaki, Lake Biwa. No specimens were taken by JORDAN and SNYDER in 1900.

20. *Tribolodon punctatus* SAUVAGE. The present author could not obtain a specimen of this species and he has taken the original description made by SAUVAGE.

21. *Leuciscus caerulescens* (SAUVAGE). This species is known only from the description by SAUVAGE and was not collected by these authors.

22. *Leuciscus phalacrocorax* JORDAN et FOWLER. The type specimen was collected in the Tama River at Tachikawa. The other specimens were obtained from Koshû and the Kinu River at Utsunomiya, Ibaraki Prefecture.

23. *Leuciscus hakuensis* GÜNTHER. This is the most abundant species of Cyprinidae in Japan. The specimens were collected from Lake Jusan in Aomori Prefecture; Kawajiri in Rikuchû; Kitakami River; Katase River near Enoshima; Matsushima Bay in Rikuzen; Same in Rikuoka (in salt water); Aomori in Rikuoka; Kitakami River in Morioka; Sendai; Niigata in Echigo; Iwai River in Ichinoseki; Tsuruga in Echizen; Kinu River at Utsunomiya; Hakodate; Otaru; Lake Biwa at Karasaki; Noyshiro; Hiroshima; a lake near Ôide, and Yokohama.

24. *Leuciscus taczanowskii* STEINDACHNER. Most of the specimens were collected in Aomori from Lake Jusan and at Noyshiro and Junsaburogata (Nishitsu River). The species name was dedicated to Professor TACZANOWSKY who was the discoverer of the present species.

25. *Leuciscus jouyi* JORDAN et SNYDER. The specimens were collected from Sasuna, Tsushima Island, and the Kaminutani River near Lake Biwa. Named for its discoverer, PIERRE LOUIS JOUY.

27. *Phoxinus steindachneri* SAUVAGE. The type specimen was collected at Lake Biwa and named for Dr. FRANZ STEINDACHNER. The authors had not yet seen this specimen.

27. *Zacco platypus* (SCHLEGEL). Numerous specimens were obtained at Tsuchiura; from the Kinu River at Utsunomiya; the Yodo River at Ôsaka; the Chikugo River at Kurume; the Yabe River at Funayado; at Nagoya in Owari; from the Tama River at Tachikawa; at Kawatana near Nagasaki and from Lake Biwa at Matsubara. The breeding males bear numerous pearl organs. The anal fin is well developed, extending somewhat beyond the base of the caudal, with pearl organs on the surface. The nuptial colors, which also appear, are much brighter than those of the female, and include silver, red, and purple. Young specimens are silvery, and a distinct grayish or pale brownish lateral band is present posteriorly.

28. *Zacco temmincki* (SCHLEGEL). The specimens were collected at Kawatana and from the Mogi

River near Nagasaki. The breeding males have horny pearl organs on the sides of the head and about the snout. This is named for Prof. C. J. TEMMINCK of Lyden, the associate of SCHLEGEL.

29. *Zacco sieboldi* (SCHLEGEL). The specimens were obtained from Lake Biwa at Matsubara; the Chikugo River at Kurume; near Nagoya in Owari; Kibami in Ômi; Funayado in Kyûshû and Karasaki on Lake Biwa. This is named for PHILIP FREDRIK SIEBOLD, of Lyden, who collected about Nagasaki and Ômura.

30. *Opsariichthys uncirostris* (SCHLEGEL). Numerous specimens were collected from Lake Biwa at Matsubara; Lake Yogo in Mino; the Yodo River at Ôsaka; and Karasaki, of Lake Biwa. The breeding males have pearl organs on the sides of the head, snout, mandible, lower surface of caudal peduncle, and anal fin. The anterior anal rays are elongate and extend to the base of the caudal. This species is very delicate and finely flavored when boiled, and is much appreciated by Japanese epicures.

31. *Ischikauia steenackeri* (SAUVAGE). The type specimen was collected from Lake Biwa. The other specimens were collected at Karasaki, Maebara, and Matsubara on Lake Biwa, and from the Yodo River, at Ôsaka.

32. *Carassius auratus* (LINNAEUS). The specimens were collected from the Chikugo River at Kurume; Tsuchiura; Same; Matsushima; Lake Biwa at Matsubara; the Yodo River in Ôsaka; Wakanoura; Aomori; Nagasaki; Owari near Nagoya; Lake Yogo at Mino; Niigata; Morioka; Sendai; Tôkyô; Kawatana and Tsuruga.

33. *Cyprinus carpio* LINNAEUS. This is very common throughout southern Japan together with *Carassius auratus*.

JORDAN, D. S. and **FOWLER, H. W.**, 1903: A Review of the Cobitidae, or Loaches, of the Rivers of Japan. Proc. U. S. Nat. Mus., 26 (1332), pp. 765–774, figs. 1–2.

The authors made a rivision of Japanese loaches, the specimens were collected by the authors and SNYDER in 1900, preserved in the U. S. Nat. Museum and in the collections of Leland Stanford Junior University. They made the family diagnosis and keys. The six species of Cobitidae were described.

1. *Misgurnus polynemus* (BLEEKER). The present species was described by BLEEKER in 1860 from Yedo (Jeddo) but the authors have not seen it to the present.

2. *Misgurnus anguillicaudatus* (CANTOR). The specimens were collected at Jusan Lake in Aomori, Hakodate, from Sapporo Museum, Tsuchiura, Nigata, Aomori, sendai, the Yodo River in Ôsaka, the Isai River at Ichinoseki, and at Morioka, Misaki, Tôkyô, Nagasaki.

3. *Elxis nikkonis* JORDAN et FOWLER This new species described from the specimens collected at Chitose, in Iburi, Hokkaidô, present in ichthyological collections of Leland Stanford Junior Univ. and Simotsuke, near Nikkô as well as Chitose, Hokkaidô, preserved in Sapporo Museum.

4. *Orthryias oreus* JORDAN et FOWLER. This new species was described from a specimen preserved in Sapporo Museum, collected at Chitose, Iburi, Hokkaidô.

5. *Cobitis taenia* LINNAEUS. The specimens are numerous series from Aomori Kitakami River, lake near Sendai (Mr. AWANO), Niigata in Echigo (Mr. EITARO IIJIMA). Tamagawa in Tachikawa, Kinu River, in Utsunomiya, Iwai River in Ichinoseki, Tôkyô, Tsuruga, Nagoya in Owari. Yodo River at Ôsaka, Chikugo River at Kurume, Kawatana and Lake Biwa.

6. *Hymenophysa curta* (SCHLEGEL). The species described from a specimen taken at Kibama, near Lake Biwa and from the specimens from the same locality, presented by the Imperial University of Tôkyô.

JORDAN, D. S. and **FOWLER, H. W.**, 1903: A Review of the Siluroid Fishes of Catfishes of Japan. Proc. U. S. Nat. Mus., 26 (1338), pp. 897–911. figs., 1–2.

The authors made the revisions on the catfishes known to inhabit the waters of Japan. The specimens concerned to this paper were collected by JORDAN and SNYDER during 1900. Here we have mentioned only the freshwater fishes.

1. *Parasilurus asotus* (LINNAEUS). The specimens were collected from Tôkyô; Niigata; Morioka; Tama River; Kawatana; Sendai; Ichinoseki; Chikugo River at Kurume; Tsuchiura; Lake Biwa at

Matubara.

2. *Fluvidraco ransonneti* (STEINDACHNER). The specimens were collected Wake River, near Wakanoura; Tsuruga; Matsubara on Lake Biwa; Lake Yogo in Mino; the Yodo River in Ôsaka and Nagoya in Owari. This was named for Baron RANSONNET, who obtained the species at Ôsaka.

3. *Fluvidraco nudiceps* (SAUVAGE). The authors described that there is no evidence of the occurrence of *Fluvidraco nudiceps* (SAUVAGE) in Japan.

4. *Pseudobagrus aurantiacus* (SCHLEGEL). The present species is very abundant in the streams of Japan. The specimens were collected from Tôkyô; Kinu River at Utsunomiya; Tama River at Tachikawa; Tsuchiura; and Kitakami River at Morioka. The author mentioned that *Pseudobagrus tokiensis* of DÖDERLEIN seems to be identical with this species, as the main characters in which it was supported to differ do not seem to be tangible.

5. *Liobagrus reini* HILGENDORF. The authors described the species on the specimen collected from Tsuyama. The other specimens collected from Niigata in Echigo, Tsuyama; and Nagoya in Owari.

1904

AKAMASTU, KUNITARO, 1904: *Salangichthys microdon.* Zool. Mag., 16 (191), pp. 323-344 (in Japanese).

The author describes many old facts on *Salangichthys microdon* referring to old Japanese books. He points out many famous fishery grounds around Japan as follows: the River Sumida, Tôkyô; the River Toyokawa, Maeshiba-mura, Hôhan-gun, Aichi Prefecture; Akasuka Mura, Kuwana-gun, Mie Prefecture; the River Saiwaibashi and the River Sawara of Yamaguchi Prefecture; Hachirô-gata, Akita Prefecture; Kahoku-gata, Kahoku-gun, Ishikawa Prefecture; Nishinomiya, Hyôgo Prefecture and Fukuoka Prefecture.

ISHIKAWA, CHIYOMATSU, 1904: Notes on Some New or little known Fishes of Japan. Proc. Nat. Hist. Tôkyô Mus., 1, pp. 1-17.

The fishes described in the present paper are contained in the collection of the Tôkyô Imperial Musum at Uyeno, Tôkyô and put aside by Dr. D. S. JORDAN of the Stanford Junior University, U. S. A. The present paper contains the freshwater fishes belonging to the families Siluridae and Cyprinidae including the following species and one variety: *Liobagrus reini* H., *Zezera hilgendorfi* ISH. *Zacco mitsukurii* ISH. *Zacco mitsukurii* var. and *Leuciscus dorobae* ISH.

JORDAN, D. S., 1904: Note on the Salmon and Trout of Japan. Proc. U. S. Nat. Mus., 28 (1399), pp. 365-366.

The author agreed to TASAKU, KITAHARA's identification of *Salmo blackistoni* HILGENDORF as a synonym of *Salmo perryi.* He also identified Japanese common trout with the scientific name of *Salmo masou* BREVOORT and *Oncorhynchus yesoensis* HILGENDORF, and agreed that many Japanese names of "Amenouwo", "Kawamasu" and "Yamabe" are the names for various different stages. *Salmo macrostoma* of GÜNTHER should be changed into *Salmo masou* by this author. JORDAN and SNYDER identified the Japanese trout as *Oncorhynchus masou,* but the present author recognized that the trout may be a dwarf female of *Oncorhynchus keta* during the breeding season. From these investigations, he gave the scientific names of the species of trout and salmon found in Japan as follows.

Oncorhynchus nerka (WALBAUM) "Benimasu". *Oncorhnchus milktschitch* (WALBAUM) "Ginmasu".
Oncorhynchus keta (WALBAUM) "Sake". *Oncorhynchus gorbuscha* (WALBAUM) "Karafutomatsu".
Salmo masou (BREVOORT) "Masu, Amenouwo, Yamabe". *Hucho perryi* (BREVOORT) "Ito".
Salvelinus kundscha (WALBAUM). *Plecoglossus altivelis* (SCHLEGEL) "Ayu".

One of these trout, *Oncorhynchus milktschitch* has not yet obtained in the waters around Japan.

JORDAN, D. S. and SNYDER, J. O., 1904: A Review of the Salmonoid Fishes of Japan. Proc. U. S. Nat. Mus., 28 (1399), pp. 365-366.

The authors published the descriptive catalogue of the Salmonidae, Argentinidae, and Salangidae from Japan. They observed the specimens obtained by them in 1900 in Japan and other specimens preserved in the museum of the Leland Stanford Junior University and in the United States National Museum. The authors describes that *Oncorhynchus masou* BREVOORT resembles *Oncorhynchus gorbuscha* but the former seems to be distinguished the larger scales and in the number of numerous branchiostegals, 13 to 16, instead of 11 or 12 in *O. gorbuscha*. The present species also resembles *O. keta*, but can be distinguished by its smaller size, smaller scales, darker fin, and narrower caudal. The specimens are collected at Aomori, from the Ishikari River, Sapporo, Hokkaidô and in the Daiya River, Nikkô, Ibaraki Prefecture. The authors takes *O. yessoensis* HILGENDORF as the synonym of the *O. gorbuscha*. They also mentions that *Salmo perryi*, which is common in the clear waters of Honshû and Hokkaidô. It is called "Yamabe" or "Yamomi" in Japanese. It reaches a weight of 8 or 10 pounds, in such large rivers as the Kitakami River, Morioka Prefecture. From his studies of many Salmonoid fishes of Japan, he concluded the scientific names as follows.

Oncorhynchus nerka (WALBAUM) ··· "Benimasu".
O. milktschitch (WALBAUM) ········· "Gi nmasu".
O. keta (WALBAUM) ························ "Sake".
O. gorbuscha (WALBAUM) ··· "Karafutomasu".
Salmo masou (BREVOORT) ··· "Masu", "Amenouwo", "Yamabe".
Hucho perryi (BREVOORT) ····················· "Ito".
Salvelinus malma (WALBAUM)······"Iwana", "Amemasu".
S. kundscha (SCHLEGEL).
Plecoglossus altivelis (SCHLEGEL) ········· "Ayu".
Mesopus olidus (PALLAS) ··················· "Chika".
Mesopus japonicus BREVOORT······"Wakasagi".

KITAHARA, TASAKU, 1904: Preliminary Note of the Salmon and Trout of Japan. Annot. Zool. Jap., 5 (3), pp. 117–120.

The preceding authors BREVOORT (1856), HILGENDORF (1876), GÜNTHER (1880), JORDAN and SNYDER (1902) dealt with the salmon and trout of Japan. The present author made the revision of these groups and concluded systematic points as follows.

Oncorhynchus keta WALBAUM (Syn. *O. haberi* HILGENDORF) "Sake".

Oncorhynchus masou BREVOORT (Syn. *O. perryi* HILG. not BREVOORT, *O. yessoensis* HILGENDORF, *Salmo macrostoma* GÜNTHER) "Masu", "Amenouwo" (land-rocked form).

Oncorhynchus nerka WALBAUM. "Benimasu".

Oncorhynchus gorbusha WALBAUM (Syn. *O. masou* JORDAN et SNYD. not. BREVOORT.) "Karafutomasu".

Oncorhynchus milktschitch WALBAUM "Ginmasu".

Hucho perryi BREVOORT (Syn. *Salmo blakistoni* HLLGENDORF). "Ito.

Salvelinus malma WALBAUM. (Syn. *Salmo kundsha* PALLAS, *Salmo pluvius* HILG.) "Iwana", "Amemasu" (sea-run form).

1905

JORDAN, D. S., 1905: A Guide to the Study of Fishes. 2 vols., New York.

This great book is in two volumes. The first volume treats mostly of the life history of fish, outer configuration, anatomy, skeleton, respiratory organ, nervous system, sense organs, genital organ, development and growth, habits, adaptation, coloration, geographical distribution, the relation between, fish fauna and channel, dispersion of freshwater fishes, edible fish, fish disease, classification, history of ichthyology, collecting, evolution and the special parts. The second volume mostly treats the classification. Here we have collected many facts concerning the freshwater fishes found in Japan, from the present books.

1. In the chapters on the geographical distribution of fishes, he mentioned the allied fish fauna between Japan and Mediteranean Seas under the control mostly of the water temperature and environment. The Black Current=Warm current '"Kuroshio" is carrying many tropical fishes into many water pools found in rocky beds along the sea-coast of Japan. The northern limit of tropical fish dis-

tribution reaches around Tôkyô. The cold current, coming from the north, extends to Matsushima Bay, Miyagi Prefecture on the Pacific side, while in Japan Sea side, it reaches far the south of Noto, Ishikawa Prefecture. Comparing the Japanese fish faunas and with the Australian ones, he found some alliance between them. He divides the region of littoral fish into the three smaller groups, Eastern Atlantic, Eastern Pacific, and Western Pacific, including Japan in the last group.

2. The distribution of freshwater fish: He divides it into the three regions; northern tropical and southern. In the first region, salmon, trout, pike, petromyzon, eel and stickleback are characteristic. A part of Japanese freshwater fish fauna may be included in this group.

3. The relation between channel and fish fauna: In this chapter the author treats of the Japanese fish fauna which is very rich and variable. The freshwater fish is allied to that of Asiatic continent, while the marine fish resembles to that of the East Indian Archipelagoes by influence of black current. At present (1905), about 900 species were found in Honshû, Hokkaidô, Kyûshû, and Shikoku, and 200 species were obtained at volcanic islands located in south and north. Among the 1100 species, 50 species are freshwater fishes but most of them are allied to those of the Asiatic Continent and some of the genera are found in China. The freshwater fish fauna is divided into north, south and intermingled regions. The northern region includes Hokkaidô and the middle and northern parts of Honshû. Demarcation between south and north may be lined crossing Mt. Fuji, Shizuoka Prefecture and Mastushima Bay, Miyagi Prefecture. In the northern region, salmon, trout, acipenser and petromyzon are characterized. In the southern region, trout and other northern elements gradually decrease in number, while minnows, sweet-fish and loaches are abundant. Two genera, *Rheopresbe* and *Bryttosus* as well as *Siluroids* are characterized, some of which were introduced from China. The origin of Japanese freshwater fish is considered to be in Asia and the most of them are characteristic in the freshwater of Japan. A wide ranged river and brook fish, *Tribolodon* could have been from a river into sea and back again into river. The author also found to this fact, that *Leuciscus jouyii* is distributing the straits of Tsushima.

4. Cormorant-fishing: He mentioned a cormorant fishing carried out in the Nagara River. He also printed a picture of fishing with cormorants in the Tama R., Kanagawa Prefecture. This original picture was painted by SEKKOKU SHIMADA, one of famous Japanese artists. In the second volume, he mentions *Acipenser kikuchii* from Japan and also *Acipenser mikadoi* from the rivers of North Japan. Salmonids of Northern Pacific are montioned. As to the genus *Oncorhynchus*, he mentiones 5 species, *O. nerka* (Blue black salmon), *O. milktschistsch* (Silver salmon), *O. keta* (Dog salmon), *O. masou* (Masu) from the Pacific coasts of American and North Japan. Dog salmon are mostly salted and used for food by the Japanese. *Oncorhynchus masou* is closely allied to humpback and abundant in the rivers of Hokkaidô. *O. nerka* is landlocked in Akan Lake, northern Hokkaidô. He also describes *Hucho blackistoni* from northern Japan, and naturalized into America and Europe. Sweet-fish, *Plecoglossus altivelis* anadromous salmon, is abundant in Formosa and Japan. Gold-fish was introduced from China and transplanted into Europe and America. In America, the tamed and cultured gold-fish escaped from an aquarium to live in natural environment, and changed the color. From a fountain pool as Washington, U. S. A., a tamed gold-fish escaped and they are now propagating in the Potamac River or changed into olive color. He says such is also the case with the rivers in Japan. *Parasilurus asotus* in China and Japan is living in ponds and supplying edible fishes. It is allied to *Parasilurus aristotelis* in the rivers of Greece. Mountain Witch, *Trachidermus ansatus*, called "Yamanokami" in Japanese, one of the family Cottidae, is living in the rivers of Japan. Scarlet patterns are marked on the body.

SMITH, HUGH, M., 1905: The Fisheries of Japan. National Geographic Society, vol. 16, no. 5, pp. 202-220.

The author mentions all kinds of fisheries carried out in Japan. Here, for the fisheries concerned to freshwater fishes are described the fishing with cormmorants and many kinds of freshwater fish cultures, namely, of the eel, the mullet, the carp, the gold-fish and several salmon and trout.

KITAHARA, TASAKU, 1905: Salmonids in Japan. Zool. Mag., 17 (200), pp. 175-176. (in Japanese).

The classification of Japanese Salmonids is still in confusion. This problem has been treated by Dutch SCHLEGEL and TEMMINCK in Fauna Japonica, American BREVOORT, German HILLGENDORF, English GÜNTHER and American JORDAN and SNYDER. They have somewhat different opinions for Salmonids classification. Here the author concludes their results into the following Japanese Salmonids species.

1. *Oncorhynchus keta* (WALBAUM) "Sake".
2. *O. masou* (BREVOORT) "Masu" (anadromous), "Amenouo" or "Yamabe" (landrocked).
3. *O. nerka* (WALBAUM) "Benimasu" (anadromous), "Kabachepu" (landrocked).
4. *O. gorbsha* (WALBAUM) "Karafuto-masu".
5. *O. milktschitch* (WALBAUM) "Ginmasu" (anadromous), "Kunimasu" (landrocked).
6. *Salmo gairdneri* RICHARDSON "Gerirara" (anadromous)' "Nijimasu" (landrocked).
7. *Hucho perryl* (BREVOORT) "Itoo".
8. *Salvelinus malma* (WALBAUM) "Amemasu" (anadromous), "Iwana" (landrocked).
9. *Osmerus dentex* STEINDACHNER "Kyuriuwo".
10. *Hypomesus olidus* (PALLAS) "Wakasagi", "Umasagi", "Chika".
11. *Plecoglossus altivelis* SCHLEGEL "Ayu" (anadromous), "Koayu" (landrocked).
12. *Salanx microdon* BLEEKER "Shirauwo".
13. *S. ariakensis* KISHINOUYE "Shirauwo".
14. *Argentina kagoshimau* JORDAN et SNYDER.

TANAKA, SHIGEO, 1905: Fishes of Kochi Prefecture, Shikoku, Japan. Zool. Mag., 17 (197), pp. 71–72. (in Japanese).

The author describes on the fishes of Kôchi Prefecture, collected by Mr. TAKEUCHI in 1904. Among these fish we could find out the following freshwater fish.

Ctenogobius similis (GILL), *Salmo perryi* BREVOORT, *Fluvidraco ransonnettii* (STEIND.), *Anguilla japonica* (T. et SCH.), *Pseudobagrus aurantiacus* (T. et SCH.), *Zacco platypus* (T. et SCH.), *Cobitis taenia* LINN.

KATO, KENZÔ, 1905: Freshwater Fishs of Fukui District. Zool. Mag, 18 (207), pp. 27-29. (in Japanese).

The author makes a list of freshwater fishes of Fukui Prefecture.

Petromyzonidae:	1. *Petromyzon japonicus* VON MARTENS……River Ashiba (Fukui City)
Siluridae:	2. *Pseudobagrus* sp.……Katsuyama, Ono-gun
	3. *Pseudobagrus* sp.……Katsuyama, Ono-gun
	4. *Parasilurus asotus* L.……a branch of the River Ashiba
	5. *Misgurnus anguillicaudatus* (CANTOR)……River Ashiba
Cyprinidae:	6. *Cyprinus carpio* L.……River Ashiba
	7. *Carassius auratus* L.……River Ashiba
	8. *Hemibarbus* T. et S.……River Ashiba
	9. *Pseudogobio esocinus* T. et S.……River Ashiba
	10. *Opsariichthys* sp.……River Ashiba
	11. *Acheilognathus intermedius* SCH.……River Ashiba
	12. *Barilius platypus* T. et S.……River Ashiba
	13. *Pseudorasbora parva* T. et S.……River Ashiba
	14. *Leuciscus hakuensis* Gunther……River Ashiba
Anguillidae:	15. *Anguilla japonica* T. et S.……River Ashiba
Salmonidae:	16. *Oncorhynchus tschawytscha* WALBAUM……River Kuzuryu
	17. *O. macrostomus* GÜNTHER……River Kuzuryu
	18. *Salmo perryi* BREVOORT……Ono-gun
	19. *Plecoglossus altivelis* T. et S.……River Ashiba
	20. *Salvelinus pluvius* HILGENDORF……Ono-gun
Engraulidae:	21. *Mesopus olidus* PALLAS……Ono-gun

Poecilidae:	22. *Aplocheilus latipes* T. et S.……River Ashiba
Serranidae:	23. *Lateolabrax japonicus* CUVIER……River Ashiba
Gasterosteidae:	24. *Gasterosteus japonicus* STEINDACHNER……Ono, Ono-gun
Mugilidae:	25. *Mugil oeur* FORBS……River Ashiba
Cottidae:	26. *Uranidae* sp.……River Ashiba

TANAKA, SHIGEO, 1905: Fishes of Kôchi Prefecture. Zool. Mag, 13 (197), pp. 21–22. (in Japanese)

He identified the specimens from Kôchi, given by Mr. TAKEUCHI, GOBUN, in 1902. The freshwater fishes are as follows:

1. *Ctenogobius similis* (GILL).
2. *Salmo perryi* (BREVOORT).
3. *Fluvidraco ransonneti* (STEIND.).
4. *Anguilla japonica* (T. & S.).
5. *Pseudobagrus aurantiacus* (T. & S.).
6. *Zacco platypus* (T. & S.).
7. *Cobitis taenia* LINNAEUS.

YASUI, KONO, 1905: Note on the Weberian Apparatus of Carp. Zool. Mag. 17 (201), pp. 207–211. (in Japanese).

The author observes the WEBERIAN Apparatus of Carp and finds out some different points in WEBERIS original descriptions.

1906

JORDAN, D. S. and **HERRE, A. CH.,** 1906: A Review of the Herring-like Fishes of Japan. Proc. U. S. Nat. Mus., 31 (1499), pp. 613–645.

They describe a list of the herring-like fishes from Japan. The specimens were collected in 1900 by JORDAN and SNYDER. Here we mention the descriptions pertaining to the freshwater fishes.

1. *Elops saurus* LINNAEUS. They have seen no specimens from Japan, but the species doubtless strays into Nagasaki.

2. *Chanos chanos* (FORSKAL). The present species was not obtained in their collection by may be found in Nagasaki.

3. *Coilia nasus* SCHLEGEL. They mentioned that the present species was originally described from Nagasaki. It has not been noticed in Japan.

JORDAN, D. S. and **SNYDER, J. O.,** 1906: A Review of the Poecilidae or Killifishes of Japan. Proc. U. S. Nat. Mus., 31 (1486), pp. 287–290.

They made a revision of the species of Poecilidae or Cyprinodontidae, found in the waters of Japan. The specimens examined were collected by the authors during 1900. They are preserved in the United States National Museum and in the Museum of Stanford University.

1. *Fundulichthys virescens* (SCHLEGEL). "Omedaka or Akitabira". They did not find this species, and no one has described it since the time of SCHLEGEL. He stated that it is very common in the brooks and little rivers which flow into the bay of Nagasaki.

2. *Oryzias latipes* (SCHLEGEL). "Medake". The present species were found in rice fields and pools of Japan, north to Tôkyô. Many specimens were secured from a stagnant pool at Wakanoura, and an equal number from a ditch in a rice field at Kawatana on Ômura Bay to the northward of Nagasaki, in company with the minnow *Rhodeus oryzae*. Specimens were also received from Prof. KEINOSUKE OTAKI from pools or brooks near Tôkyô. It is very common in all mosquito breeding waters in southern Japan (JORDAN).

JORDAN, D. S. and **SEALE, A.,** 1906: Descriptions of Six New Species of Fishes from Japan. Proc. U. S. Nat. Mus., 30 (1445), pp. 143–148.

The species noted in the present paper were secured from Japan in 1900, by JORDAN and SNYDER.

Here we list only the freshwater fishes.

1. *Phoxinus septentrionalis* JORDAN et SEALE. Twelve specimens were obtained in a small stream at Aomori City, Aomori Prefecture, in northern Japan. The type, No. 53411, was in U. S. National Museum, and cotype No. 9257 in Stanford University.

2. *Leuciscus caerulescens* SAUVAGE. The present species was originally described from Lake Biwa. In the present report, two specimens were described from Kawatana, near Nagasaki, Kyûshû.

3. *Rhodeus oryzae* JORDAN et SEALE. Seven specimens were obtained in a ditch in a ricefield at Kawatana, northwest of Nagasaki, Kyûshû. It was found together with small Cyprinodont, *Aplocheilus latipes*. The type specimen, No. 53412, is in United States National Museum and the cotype No. 9258 in Stanford University.

4. *Rhinogobius nagoyae* JORDAN et SEALE. The present specimen 2.55 inches long, was sent from Nagoya, Japan by KEINOSUKE OTAKI. The type, No. 9296, is preserved in Stanford University.

JORDAN, D. S. and **SNYDER, J. O.**, 1906: A Synopsis of the Sturgeons (Acipenseridae) of Japan. Proc. U. S. Nat. Mus., 30, pp. 397-398.

They described two species of Sturgeon, *Acipenser kikuchii* JORDAN et SNYDER and *Acipenser mikadoi* HILGENDORF. The former specimen measured 1.8 meters long and preserved in the Museum of Imperial University of Tôkyô. It was secured in a net at the station off Misaki, Sagami Bay, Kanagawa Prefecture. The species name was dedicated for Prof. DAIROKU KIKUCHI, late president of the Imperial University of Tôkyô. The latter specimens measured 1 1/3 meters in length. The first one was collected in the Ishikari River in Hokkaidô, the others from streams in Teshio and Mikawa in Hokkaidô. This is the common sturgeon of northern Japan. They were preserved in the Imperial Museum of Tôkyô.

KATÔ, KENZO, 1906: Freshwater Fishes of Fukui Districts. Zool. Mag., 18 (207), pp. 27-29. (in Japanese).

He has listed the 27 species of freshwater fishes from Ashiba River, Kuzuryû River, Katsuyama, Ôno-gun, Ôno, Ôno-gun. Fourteen species of true freshwater fishes are known as follows. Petromyzonidae……*Petromyzon japonicus*; Siluridae……*Pseudobagrus* sp., *Parasilurus asotus*; Cobitidae……*Misgurnus anguillicaudatus*; Cyprinidae……*Cyprinus carpio*, *Carassius auratus*, *Hemibarbus barbus*, *Pseudogobio esocinus*, *Opsarichthys sp.*, *Acheilognathus intermedius*, *Barilius platypus*, *Pseudorasbora parva*, *Leuciscus hakuensis*; Poecilidae……*Aplocheilus latipes*.

1907

ABE, RYOHEI, 1907: The Distribution of Stickleback. Zool. Mag., 19 (226), pp. 253-254. (in Japanese).

The author reported that *Gasterosteus aculeatus* L. was found in Yonago, Tottori Prefecture. This fish ascends the river during the end and midde of March and comes in paddy fields to make a nest and then descends the river into the sea. The youngs remain in a group for a while in canals or streams after their parents disappear.

BERG, L., 1907; A Review of the Cobitoid Fishes of the Basin of the Amur. Proc. U. S. Nat. Mus., 32 (1533), pp. 435-438.

The author made a revision of the *Cobitidae* found in the Amur River and of the preserved specimens in Peterburg Museum and American National Museum. He made a comparison of the scales of *Misugurnus fossilis anguillicaudatus* (CANTOR) collected in Japan, but not remarked the difference between them. As for the Japanese specimens the height of body measures 6.3-9.1 mm., somewhat higher than the others. He compared the specimens collected at Penking, China with those collected by SCHLEGEL in Japan and noted that the Japanese specimens have a brighter color but the specimens collected at Nagasaki, Japan, are of nearly the same color as that of from the Amur River. The au-

thor took *Orthrias oreas* by JORDAN and FOWLER (collected at Chitose, Hokkaidô) under the synonym of *Nemacheilus barbatulus toni* (DYBOWSKI). The difference between the genus *Orthrias* established by JORDAN and the genus *Nemacheilus* is very slight with the characters of the truncated caudal end. But the Asiatic species of *Nemacheilus* has a biforked caudal end while young and when in the adult it has a truncated caudal end. He also realized that the Japanese, European and Amur specimens are all entirely similar.

HATTA, SABURO, 1907: On the Gastrulation in *Petromyzon.* Jour. Coll. Scie. Imp. Univ. Tôkyô, 21 (11), pp. 1-44.

The author studies the Gastrulation in Petromyzon, which he describes in this report. The descriptions cover from the old morula stage to Gastrula stage.

JORDAN, D. S. and **RICHARDSON, R, E.,** 1907: On a Collection of Fishes from Echigo, Japan. Proc. U. S. Nat. Mus., 33, pp. 263-266, figs. 1-3.

They described three new species from a small collection made by Mr. MASAO NAKAMURA, a teacher in the school of Nagaoka, in the province of Echigo. Series of the specimens mentioned are preserved in the United States National Museum and in the museum of Stanford University.

1. *Lefua echigonia* JORDAN et RICHARDSON. This new species was found in a stream near Nagaoka, in Echigo, Japan, on the northwestern part of Honshû. Three specimens, measuring 1 1/2 to 1 3/4 inches long, are preserved in Stanford University as the type No. 20164. A cotype is in the United States National Museum. The authors mentioned that it is related to *Lefua nikkonis* (JORDAN et FOWLER), differing from it, however, in its much smaller scales, shorter ventral fins, and in its coloration, there being no caudal blotch.

2. *Chloea nakamurae* JORDAN et RICHARDSON. Three specimens, 1 3/4 to 2 inches in length, were obtained at Nagaoka, in Echigo, Japan. The type specimn No. 20163 is preserved in Stanford University and cotypes are in the United States National Museum. The female specimens are distended with eggs and the male is provided with dark colored fins and branchiostegals, indicating the nuptial coloration.

JORDAN, D. S., 1907: Fishes. pp. 1-789, figs. 1-673, pls. 1-18.

In this book, the author described some notes for Japanese fishes and here we extracted them. In his chapter about the geographical distribution, he made the descriptions as follows. "Species absent through barriers. The absence from the Japanese fauna of most European or American species comes under the first head. The pike has never reached the Japanese lakes, though the shape of the lotus leaf in the many clear ponds would suit its habits exactly." "Temperature the central fact in Distribution: Knowing the average temperature of the water in a given region we know in general the types of fishes which must inhabit it." "It is the similarity in temperature and physical conditions which chiefly explains the resemblance of the Japanese fauna to that of the Mediterranean or the Antilles. "In like fashion, young fishes from the tropics drift northward in the Kuro Shiwo to the coasts of Japan, but never finding a permanent breeding-place and never joining the ranks of the Japanese fishes," "Agency of ocean currents. The westward current from Hawaii reaches Luzon and Formosa. It is deflected to northward and, joining a northward current from Celebes, it forms the Kuro Shiwo or Black Stream of Japan, which strews its tropical species is the rock pools along the Japanese promontories as far as Tôkyô. Then, turning into the open sea, it passes northward to the Aleutian Islands, across to Siberia. Thence it moves southward as a cold current, bearing Ochotsk-Alaskan types southward as far as the Santa Barbara Islands, to which region it is accompained by species of Aleutian region. A cold return current seems to extend southward in Japan, along the east shore perhaps as far as Matsushima. A similar current in the sea to the west of Japan extends still further to the southward, to Noto, or beyond. In comparing the Japanese fauna with that of Australia, we find some trace of both these conditions. Certain forms are perhaps excluded by cross-currents, while certain others seem to have been influenced only by the warmth of the water." "Northern Zone. With

Dr. GÜNTHER we may recognize first the Northern Zone, characterized familiarly by the presence of sturgeon, salmon, trout, white-fish, pike, lamprey, stickleback, and other species of which the genera and often the species are identical in Europe, Siberia, Canada, Alaska, and most of the United States, Japan and China. This is subject to cross-division into two great districts, the first Europe-Asiatic, the second North American." "Variety of tropical fishes. In the tropics on one species is represented by enormous numbers of individuals as is the case in colder regions. On the other hand, the number of species regarded as food-fishes is much greater in any given port. Upward of too different species appear in the markets of Japan. In England, on the contrary, about 50 species make up the list of fishes commonly used as food. Yet the number of individual fishes is probably not greater about Japan or Hawaii than in a similar stretch of British coast." "Economic Fisheries. Special local methods, such as the use of the tamed cormorant in the catching of the "Ayu", by the Japanese fishermen at Gifu, may be set aside for the moment, and all general methods of fishing come under one of these four classes. ... In the chapter of Salmonidae, "Oncorhynchus, the Quinnat Salmon... Five species of Oncorhynchus are well known on both shores of the North Pacific, besides one other in Japan. These have been greatly misunderstood by early observers on account of the extraordinary changes due to differences in surroundings, in sex, and in age, and in conditions connected with the process of reproduction. There are five species of salmon (*Oncorhynchus*) in the waters of the North Pacific, all foand on both sides, besides one other which is known only from the waters of Japan.

1) The quinnat (*Oncorhynchus tschawytscha*), or king-salmon, 2) the blue-back salmon, or reddish (*O. nerka*), 3) the silver salmon (*O. milktschitsch*), 4) the dog salmon, 5) the humpback salmon (*O. gorbuscha*), and 6) the masu (*O. masou*).

"These little fishes often appear in mountain lakes, but whether they are landlocked or have come up from the sea is still unsettled. These dwarf forms, called "kokos" by the Indians and "Benimasu" in Japan, form the subspecies *Oncorhynchus nerka kennerlyi*. The flesh in this species is firmer than that of any other and very red, of good flavor, though drier and less rich than the King-Salmon."

"The dog-salmon, calico salmon, or chum, called Saké in Japan (*Oncorhynchus keta*), reaches an average weight of about 7 to 10 pounds. It has about 14 anal rays, 14 branchiostegals, 24 (9+15) gill-rakers, and 140 to 185 pyloric coeca. There are about 150 scales in the lateral line. In spring it is dirty silvery, immaculate, or sprinkled with small black specks, the fins dusky, the sides with faint traces of gridiron-like bars. In the fall the male is brick-red or blackish, and its jaws are greatly distorted. The pale flesh is well flavored when fresh, but pale and mushy in textre and muddy in taste when canned. It is said to take salt well, and great numbers of salt dog-salmon are consumed in Japan." "The Masu, or Yezomasu (*Oncorhynchus masou*), is very similar to the humpback, the scales a little larger, the caudal without black spots, the back usually immaculate. It is one of the smaller salmon, and is fairly abundant in the streams of Hokkaidô, the island formerly known as Yezo."

"Nerka is known in Japan only as landlocked in Lake Akan in Northern Hokkaidô. Milktschitsch is generally common, and with masou is known as masu, or small salmon, as distinguished from the large salmon, or Saké. Tschawytscha and Gorbuscha are unknown in Japan. Masou has not been found elsewhere." "The absence of the fine spring salmon in the streams, and few of them pass through lakes which are not shut off by waterfalls. For the same reason neither of these species is likely to be come naturalized in the waters of our Eastern States, though it is worth while to bring the red salmon to the St. Lawrence. The silver salmon, already abundant in Japan, should thrive in the rivers and bays of New England."

"Hucho, the Huchen.... The genus *Hucho* has been framed for the Huchen or Rothfisch (*Hucho hucho*) of the Danube, a very larger trout, differing from the genus *Salmo* in having no teeth on the shaft of the vomer, and from the Salvelinus at least in form and coloration.... In northern Japan is a similar species, *Hucho blackistonii*, locally known as Ito, a large and handsome trout with very slender body, reaching a length of 2 1/2 feet. It is well worthy of introduction into American and European waters." "In northern Japan occurs *Salvelinus pluvius*, the Iwana, a species very similar to the Dally Varden, but not so large or so brightly colored."

"The "Ayu", or Sweetfish, of Japan, *Plecoglossus altivelis*, resembles a small trout in form, habits, and

scaling. Its teeth are, however, totally different, being arranged on serrated plates on the sides on the jaws, and the tongue marked with similar folds. The "Ayu" abounds in all clear streams of Japan and Formosa. It runs up from the sea like a salmon. It reaches the length of about a foot. The flesh is very fine and delicate, scarcely surpassed by that of any other fish whatsoever. It should be introduced into clear short streams throughout the temperate zones. In the river at Gifu in Japan and in some other streams the "Ayu" is fished for on a large scale by means of tamed cormorants. This is usually done from boats in the night by the light by torches."

"Cormorant-fishing.... The following account of cormorant fishing is taken, by the kind permission of Mr. CASPAR W. WHITNEY, from an article contributed by the writer to Outing, April, 1902: Tamagawa means Jewel River, and no water could be clearer. It rises somewhere up in the delectable mountains to the eastward of Musashi, among the mysterious pines and green brown fir-tree and it flows across she plains bordered by rice-fields and mulberry orchards to the misty bay of Tôkyô. It is, therefore, a river of Japan, and along its shores are quaint old temples, each guarding its section of primitive forest, picturesque bridges, huddling villages.... But the one fish of all its fishes is the "Ayu". This is a sort of dwarf salmon, running in the spring and spawning in the rivers just as a salmon does. But it is smaller than any salmon, not larger than a smelt, and its flesh is white and tender, and so very delicate in its taste and odour that one who tastes it crisply fried or broiled feels that he has never tasted real fish before. In all its anatomy the "Ayu" is a salmon, a dwarf of its kind, one of which ancestors in England would have called a "smelt". Its scientific name is *Plecoglossus altivelis*. *Plecoglossus* means plaited tongue, and *altivelis*, having a high sail; for the skin of the tongue is plaited or folded in a curious way, and the dorsal fin is higher than that of the salmon, and one poetically inclined might, if he likes, call it a sail.... The teeth of the "Ayu" are very peculiar, for they constitute a series of saw-edged folds or plaits along the sides of the jaws, quite different from those of any other fish whatsoever. In size the "Ayu" is not more than a foot to 15 inches long. It is like a trout in build, and its scales are pist by the ancient Temple of Tamagawa, with its famous inscribed stone, given by the Emperor of China.

"At the farmhouse, commodius and hospitable, likewise clean and charming after the fashion of Japan, we send for the boy who brings our fishing-tackle. They come wadding into the yard, the 3 birds with which we are to do our fishing. Black cormorants they are, each with a white spot behind its eye, and a horse voice, come of standing in the water, with which it says y-eugh whenever a stranger makes a friendly overture. The cormorants answer to the name of Ôu, which in Japanese is something like the only ward the cormorants can say. The boy puts them in a box together and we set off across the drifted gravel to the Tamagawa. Arrived at the stream, the boy takes the 3 cormorants out of the box and adjusts their fishing-harness. This consists of a tight ring about the bottom of the neck, of a loop under each wing, and a directing line. Two other boys take a low net. They drag it down the stream, driving the little fishs..."Ayu", "Zakko", "Haë", and all the rest before it. The boy with the cormorants goes in advance. The 3 birds are eager as pointer dogs, and apparently full of perfect enjoyment. To the right and left they plunge with lightning strokes, each dip bringing up a shining fish. When the birds neck is full of fishes down to the level of the shoulders, the boy draws him in, grabs him by the leg, and shakes him unceremoniously over a basket until all the fishes have flopped out. The cormorants, watch the sorting of the fish with eager eyes and much repeating of y-eugh, the only word they know. The Ayu are not for them, and some of the "Kajikas" and "Haźes" were prizes of science. But "Zakko" (the dace) and "Haë" (the minnow) were made for the cormorant. The boy picks out the chubs and minnows and throws them to one bird and then another. Each catches his share on the fly, swallows it at one gulp, for the ring is off his neck by this time, and then says y-eugh, which means that he likes the fun, and when we are ready will be glad to try again. And no doubt they have tried it many times since, for there are plenty of fishes in the Jewel River, "Zakko" and "Haë" as "Ayu".

OTAKI, KEINOSUKE, 1907: Sticklebacks of Japan. Trans. Sap. Nat. Hist. Soc.,* vol. 2, pp. 85–91.

* Trans. Sap. Nat Hist. Soc. = Transactions of Saporo Natural History Society published by the Sapporo Natural History Society, Hokkaidô.

(in Japanese, with English summary)

The author describes Stickle-backs found in Japan on a systematic point. He confirms two genera and 3 species; *Gasterosteus cataphractus* PALL., *Pygosteus steindachneri* JORDAN et SNYDER., *Pygosteus brevispinosus* OTAKI,* *Pygosteus undecimalis* JORDAN et STARKS. Which new species is now under a synonyme of *Pungitius pungitius.*

OTAKI, KEINOSUKE, 1907: The Common Sturgeon of Hokkaidô. Trans. Sapp. Nat. Hist. Soc., vol. 2, pp. 79–84. (in Japanese with English summary)

The writer describes three species of sturgeon *Acipenser mikadoi* HILGENDOLF and *A. kikuchii* JORDAN et SNYDER. *Acipenser guldenstädtii* which was found in Russia, may be distributed in the Japan Sea. During the months of July and August young sturgeons of about 4–5 cm. long and in the later season, larger and full grown examples of 170 cm. in length are found common in the fish market of Sapporo. They are caught in the large rivers of Ishikari and Teshio of Hokkaidô. Of these there in the College of Agriculture, the Tôhoku Imperial University, three large stuffed specimens of 170–180 cm. in length and many other small ones of different sizes are preserved in formalin. One of the large specimens is female, which is an especially good example being not deformed as is often the case with the stuffed specimens.

TANAKA, SHIGEO, 1907: A Report on Fish (II). Zool. Mag., 19 (226), pp. 223–224. (in Japanese).

The author listed up the freshwater fishes from Tsukiji-gun, Kanagawa Prefecture as follows. *Cobitis taenia, Chaenogobius macrognathus.* He also listed up the freshwater fishes from Kamiho-mura, Kami-gun, Gifu Prefecture. *Cottus kazika, Cobitis taenia, Salmo peryi, Liobagrus reini, Leuciscus jouyi, Lampetra japonica, Gobius sp. Zacco platypus, Zacco temmincki, Pseudogobio esocinus.*

1908

KOSHIDA, TOKUJIRÔ, 1908: Notes on the Fishes found in Lake Inawashiro, Fukushima Prefecture. Suisan Ken-kyushi,* 3 (9), pp. 225–227. (in Japanese).

Lake Inawashiro is located at an elevation of 515 meters, the perimeter is about 13 Ri, surface area 7 square Ri, the greatest depth 102 meters, 34 meters average depth. In olden times there were numerous *Carassius auratus* and *Anguilla japonica* but since the eruption of Mt. Bandai the water contains a considerable amount of sulphric salts which has decreased the fish population. The author investigated the lake in August of 1908 and found the following 18 species. *Lampetra japonica, Parasilurus, asotus, Liobagnus reini, Misgurnus anguillicaudatus, Cobitis taenia, Acheilognathus limbata* "(*Bote*)", *Leuciscus hakuensis, Hemibarbus barbus, Acheilognathus limbatum* "(*Tanago*)", *Uranidae hilgendorfi, Aplocheilus latipes, Otakia rastornia, Cyprinus carpio, Anguilla japonica, Oncorhynchus masou, Salmo irideus, Salvelinus pluvius* "(*Iwana*)". *Salvelinus leucomaenis* "(*Amemasu*)".

KOSHIDA, TOKUJIRÔ, 1908: Does the Trout spawn in Successive Years. Suisan Ken-kyûshi, 3 (1), pp. 7–9. (in Japanese).

In Japan, the female trout may spawn 3–4 years after hatching and the male matures in 2 years, Chitose hatchery, Hokkaidô Fisheries Experimental Station, announced the trout spawn annually. The author doubted that the Japanese trout could breed in successive years as the first spawn may occur in 3 or 4 year old females and the ovary could not recover again the next year. Most of the females were killed after spawning by the salmon pests and could not breed twice in their lives. He noted that the report about the successive breedings published in Japan is due to misunderstanding the rest period of the ovary under the conditions of artificial ovulation, which makes spawning the next year possible.

* Suisan Ken-kyûshi = Suisan Ken-kyûshi, a monthly Magazine for Fisheries published by Rakusui-Kai, Tôkyô Fisheries University.

KOSHIDA, TOKUJIRÔ, 1908: Fishes of Lake Inawashiro. Suisan Ken-kyûshi, 3 (9), pp. 17-19. (in Japanese).

The author collected specimens from Lake Inawashiro during August 18th and 31st.

1. *Lampetra japonica* VON MARTENS. It lives in a river connecting with the lake. The body attains 20-25 cm. length.

2. *Parasilurus asotus* LINN. It lives in deep and muddy depths. During May and June, it ascends the river from the lake. It is said that this fish was introduced in the "Ansei" Era. (1854-1859).

3. *Liobagrus reini* HILGENDORF. It lives in sandy and deep bottom.

4. *Misgurnus anguillicaudatus* CANTOR. It lives on the bottom of canal or in the lakes of muddy bottom. In spring it ascends the river to spawn.

5. *Cobitis taenia* LINNAEUS. It lives in sandy small streams.

6. *Acheilognathus limbata* SCHLEGEL. It lives in pebbly bottomed rivers. It attains 20-25cm. in body length. Spawning season is June and July.

7. *Leuciscus* GÜNTHER. It is quite abundant in Lake Inawashiro and likes to live in clear sandy places. The breeding season, from May to April. It deposits eggs on a large stone.

8. *Hemibarbus barbus* T. et S. It lives in sand-muddy places, aboundant around Kadata, Chitose-mura, found in deep places in winter. The breeding season is June and July.

9. *Acheilognathus limbatum* T. et S. It lives in lakes and rivers. It attains only 6-9cm. in body length. In the spring it deposits eggs on the weeds.

10. *Uranidea hilgendorfi* STEINDACHNER (*Cottus kazika* ?). It lives in lakes and rivers and likes to live in sandy places. In the spring, it deposits eggs. Other two species are included in this group.

11. *Aplocheilus latipes* T. et S. It lives in lakes and rivers. In the spring, it breeds on.

12. *Otakia rasborina* JORDAN et SNYDER. It lives in the sandy bottom of the lake. The breeding season is June and July.

13. *Cyprinus carpio L.* This fish was introduced by Mr. MATSUDAIRA into the lake during (1830-1843).

14. *Anguilla japonica* SCHLEGEL. During 1830-1843, Mr. MATSUDAIRA also introduced this eel into the lakes. It lives in muddy bottoms.

15. *Oncorhynchus masou* BREVOORT. This fish also was introduced by the Agriculture Department during 1886 and 1892. It lives in the southeastern part of the lake and ascends the river from the lake to spawn.

16. *Salmo irideus* GIBON. This American trout wes introduced from the Shiroko Fishculture ground, Kitaadachi-gun, Saitama Prefecture in 1880. It lives mostly in the southeastern part of the lake and ascends the rivers Funatsu and Hara from the lake at the end of September and down to the end of October.

17. *Salvelinus fontinalis* HILGENDORF. It lives in the upper streams of the lake, mostly the lake Hibara and Shin. This was also introduced by the Agriculture Department during 1889 and 1890.

18. *Salvelinus fontinalis* HILGENDORF? It lives in the southeastern part of the lake and ascends the rivers Hamachi and Ôya to spawn.

TANAKA, SHIGEO, 1908: On Some Fishes from Lake Biwa, with Description of One New Species and a List of all the Fish Species hitherto known from that Locality. Ann. Zool. Jap., 7 (1), pp. 1-15.

A large collection of Lake Biwa fishes is preserved in the Zoological Institute, Science College, Imperial University of Tôkyô. The author makes observations on the whole specimens and appends a list of all the fish species in Lake Biwa that have thus far become known. He listed 55 species which belong to 8 families and 39 genera. A new species *Acheilognathus shimazui* for which the author proposes new to science.

TANAKA, SHIGEO, 1908: Descriptons of Eight New Species of Fishes from Japan. Ann. Zool. Jap., 7 (1), pp. 27-47.

The author mentions eight new marine and freshwater fishes from Japan; two of these belong to freshwater *Ctenogobius kurodai* and *C. katonis* (Gobiide). The first new species are found in a freshwater pond in the garden of Dr. KURODA in Fukuyoshicho, Akasaka, Minato-ku, Tôkyô. The largest specimen attains 3.6 cm. long without coudal. It is preserved in the Zoological Museum of the Science College, registered No. 2008. The species is named after Dr. N. KURODA by whom it was discovered. The second new species *Ctenogobius katonis*. The specimen of this type was collected from freshwaters in Kanazawa City, Ishikawa Prefecture by Mr. K. KATÔ, after whom the species is named. The type specimen attains 6.1 cm. long without caudal, and is kept in the Zoological Museum, Science College, the register number being 2002.

TANAKA, SHIGEO, 1908: Fish Fauna of Lake Biwa. Zool. Mag., 20 (237), pp. 233-237. (in Japanese).

The author listed up 9 Families; Petromyzontidae, Siluridae, Cobitidae, Cyprinidae, Anguillidae, Salmonidae, Poeciliidae, Gobiidae, Cottidae, and 41 genera and 57 species. He noted a new species *Acheilognathus shimazui* TANAKA with a brief description as follows.

Two specimens, larger one 5.3 cm. long, without caudal. D. III. 8; A. II. 10, L. Lat. 32 to 35. Lat. trans. 5+3 or 6+3. The species is allied to *Acheilognathus lanceolata*, but differs from this in its larger scales, longer barbel and higher body and in markings, especially in those of vertical fins. The type specimen is obtained at Tokiwa-mura, Kurita-gun, Kyôto, collected by Shimazu.

Lirted species is as follows.

1. *Lampetra japonica* (VON MARTENS).
2. *Liobagrus reinii* HILGENDORF.
3. *Fluvidraco ransonneti* (STEIDACHNER).
4. *Fluvidraco nudiceps* (SAUVAGE).
5. *Parasilurus asotus* (LINNAEUS).
6. *Pseudobagrus aurantiacus* (SCHLEGEL).
7. *Misgurnus anguillicaudatus* (CANTOR).
8. *Cobitis taenia* LINNAEUS.
9. *Hymenophysa curta* (SCHLEGEL).
10. *Paracheilognathus rhombea* (SCHLEGEL).
11. *Paracheilognathus longipinnis* REGAN).
12. *Acheilognathus lanceolata* (SCHLEGEL).
13. *Acheilognathus limbta* (SCHLEGEL).
14. *Acheilognathus cyanostigma* JORDAN et FOWLER.
15. *Acheilognathus shimazui* TANAKA (MS.).
16. *Leucogobio jordani* ISHIKAWA.
17. *Leucogobio biwae* (JORDAN et SNYDER).
18. *Leucogobio mayedae* JORDAN et SNYDER.
19. *Leucogobio güntheri* ISHIKAWA.
20. *Zezera hilgendorfi* (ISHIKAWA).
21. *Sarcocheilichthys variegatus* (SCHLEGEL).
22. *Abbottina psegma* JORDAN and FOWLER.
23. *Zacco platypus* (SCHLEGEL).
24. *Zacco sieboldi* (SCHLEGEL).
25. *Zacco temmincki* (SCHLEGEL).
26. *Pseudogobio esocinus* (SCHLEGEL).
27. *Otakia rasborina* JORDAN et SNYDER.
28. *Pseudorasbora parva* (SCHLEGEL).
29. *Ischikauia steenackeri* (SAUVAGE).
30. *Leuciscus hakuensis* GÜNTHER.
31. *Leuciscus jouyi* JORDAN et SNYDER.
32. *Leuciscus caerulescens* (SAUVAGE).
33. *Leuciscus japonicus* (SAUVAGE).
34. *Phoxinus steindachneri* SAUVAGE.
35. *Gnathopogon elongatus* (SCHLEGEL).
36. *Biwia zezera* (ISHIKAWA).
37. *Hemibarbus barbus* (SCHLEGEL).
38. *Opsariichthys uncirostris* (SCHLEGEL).
39. *Carassius auratus* (LINN.).
40. *Cyprinus carpio* LINN.
41. *Tribolodon punctatus* (SAUVAGE).
42. *Anguilla japonica* SCHLEGEL.
43. *Oncorhynchus masou* (BREVOORT).
44. *Salmo perryi* BREVOORT.
45. *Plecoglossus altivelis* SCHLEGEL.
46. *Oryzias latipes* (SCHLEGEL).
47. *Fundulichthys virescens* (SCHLEGEL).
48. *Cottus pollux* GÜNTHER.
49. *Ctenogobius similis* (GILL).
50. *Chaenogobius castaneus* (O' SHANGHNESSY).
51. *Chaenogobius macrognathus* (BLEEKER).
52. *Odontobutis obscurus* (SCHLEGEL).
53. *Eleotris oxycephalus* (SCHLEGEL).
54. *Acanthogobius flavimanus* (SCHLEGEL).
55. *Chaeturichthys hexanemus* (BLEEKER).

TANAKA, SHIGEO, 1908: Fish Report (7) Fishes from the River Chikuma, Nagano Prefecture. Zool.

Mag. 20 (232), pp. 19–20. (in Japanese).

The freshwater fishes were caught at the River Chikuma. Mr. Miyo, OSAWA obtained many specimens from the River Chikuma, in February of 1907 and presented them to Dr. S. TANAKA. Freshwater Fishes are:

Cobitis taenia, Liobagrus reini, Cottus pollux, Pseudogobio esocinus, Leuciscus hakuensis, Cyprinus carpio, Carassius auratus.

1909

KOSHIDA, TOKUJIRÔ, 1909: Notes on *Salmo iridius* GIBBON in the Lake Inawashiro. Suisan-kenkyûshi, 4 (2), pp. 43–45. (in Japanese).

Two specimens are caught in the River Funatsu and Inawashiro Lake on October 29th, 1941. The specimen attains 40 cm. in body length; the features are somewhat slender, the head length $\frac{1}{4}$ of body length; the snout length $3\frac{2}{3}$ of head length; dorsal fin in the middle of the back, with 13–14 fin rays, pelvic fin in the middle of the end of the dorsal and the base of caudal fin, with 13 fin rays. The teeth arranged in one line on both jaws, the anterior is somewhat larger than the posterior one. The typical Rainbow trout (*Salmo irideus*) were introduced from the United States in about 1880 into this lake. It lives in the lake and breeds during the beginning of September to the middle of November. In this season it ascends the River Funatsu and other branches, the River Hara and the River Tokonatsu. The fishes ascending the rivers, attains 36 cm. and the male is larger than the female. A female has 700–1000 eggs. This rainbow trout has been often introduced into Japan, into Lake Nikkô Chugûshi and other lakes but no eggs could be got in their females. The author confirms that for the fishes to be transplanted from America in future *Şalmo irideus* may be the best.

KOSHIDA, TOKUJIRÔ, 1909: The Calculation of Annual Teeth and Homing Period of *Oncorhynchus keta*, WALBAUM, Suisan Ken-kyûshi, 4 (7), pp. 171–178. (in Japanese).

The author examined the Salmon of the River Miomote, Niigata Prefecture and one from Hokkaidô by the calculation method of annual teeth. From the observations, he concluded that 4 th year *Oncorhynchus keta* was mostly caught in Niigata Prefecture and 5 th year one in Hokkaidô. But he considers that the 6 th and 7 th aged samlon are usual homing back salmon in these districts. So he must have some more research on the homing year salmon.

KOSHIDA, TOKUJIRÔ, 1909: On *Oncorhynchus kawamurai*. Suisan Ken-kyûshi, 5 (5), pp. 6–15. (in Japanese).

The author describes *Oncorhynchus kawamurai* which is found specially in Lake, Tazawa, Senhoku-gun, Akita prefecture. Some authority reports that is a land-rocked form of *Oncorhynchus kisutch* WALBAUM. KITAHARA, TASAKU says thst the fish resembles *Oncorhynchus masou* BREVOORT, somewhat changed by the food and water of Lake Tazawa. From these facts, the scientific name is not yet ascertained. The author examined the two specimens from the lake. The characters are D. 13 (14): A. 16–17 (18); p. 15–16; V. 10; C. 19. Branchiostegals 12 (13); Gill-rakers $\frac{14\ (17)}{20\text{–}21}$; L. Lateral 130-31; L. transverse $\frac{20\text{–}22}{28\text{–}33}$; Caeca pylorica 46–52; Vertebrae 68. In the outer feature, this is like *O. masou* and *O. nerka* WALBAUM. The nasal aperture is somewhat larger than those of *O. keta* and *O. masou*. The number of pyloric caeca is smaller (30–40 in number), the posterior margin of preopercle arched, branchiostegals numerous and very minute. From these and other peculiar characters, the author considers that this fish is somewhat different from other species and may be distinct species.

TANAKA, SHIGEO, 1909: Fishes of the Prefecture of Gifu. Zool. Mag, 21 (244), pp. 14-67. (in Japanese).

The author listed up the fishes produced from the Gifu Prefecture.

1. *Lampetra japonica* (von MARTENS); The River Nagara and the River Masuda.
2. *Parasilurus asotus* (LINN.); The River Ibi.
3. *Liobagrus reini* HILGENDORF; The River Nagara.
4. *Fluvidraco ransonnetii* (STEINDACHNER).
5. *Cobitis taenia lineata*; The River Nagara.
6. *Misgurnus anguillicaudatus* (CANTOR); The River Nagara.
7. Colored *Misgurnus anguillicaudatus*; The River Nagara.
8. *Acheilognathus lanceolatus* (SCHLEGEL); The River Nagara.
9. *Ach. limbata* (JORDAN et FOWLER); A branch of the River Nagara.
10. *Ach. intermedia* (SCHLEGEL); A branch of the River Nagara.
11. *Acheilognathus shimazui* TANAKA. Inabagun; the River Nagara.
12. *Zacco temmincki* (SCHLEGEL). A branch of the Nagara.
13. *Sarcocheilichthys variegatus* (SCH.) The River Ebi; a branch of the River Ebi.
14. *Biwia zezera* (ISHIKAWA).
15. *Pseudorasbora parva* (SCHLEGEL). A branch of the River Nagara.
16. *Pseudogobio esocinus* (SCH.) A branch of the River Nagara.
17. *Pseudorasbora parva* (SCH.) A branch of River Nagara.
18. *Paracheilognathus rhombea* (SCHLEGEL). The River Nagara.
19. *Leucogobio güntheri* ISHIKAWA. The River Ebi.
20. *Leucogobio mayeda* (JORDAN et SNYDER).
21. *Leucogobio biwae* (JORDAN et SNYDER).
22. *Leucogobio jordani* ISHIKAWA. The River Ebi and the River Nagara.
23. *Zacco platypus* (SCHLEGEL). Inaba-gun; a branch of the River Nagara.
24. *Leuciscus hakuensis* GÜNTHER.
25. *Cyprinus carpio* LINNAEUS. A branch of the River Nagara and the Ebi.
26. *Carassius auratus* (LINN.) A branch of the River Ebi, Yatomi-mura, Gunjô-gun, a branch of the River Nagara.
27. *Anguilla japonica* SCHLEGEL. Kamijô-gun, a branch of the River Nagara.
28. *Oncorhynchus masou* (BREVOORT). The River Ebi; the River Masuda; the River Ebi; the River Neo; Mugi-gun.
29. *Plecoglossus altivelis* SCH. The River Kiso; a branch of the River Nagara.
30. *Oryzias latipes* (SCHLEGEL). The River Gunjô.
31. *Fundulichthys virescens* (SCHLEGEL). The River Nagara.
32. *Gasterosteus cataphractus* (PALLAS). A branch of the River Nagara.
33. *Hyporhamphus sajori* (SCHLEGEL).
34. *Mugil cephalus* FORSKAL. The River of Ebi.
35. *Lateolabrax japonicus.* (CUV. et VALL.). The River of Ebi; the River Kiso.
36. *Cottus pollux* GÜNTHER. The River Nagara; a branch of Nagara River.
37. *Odontobutis obscurus* (SCHLEGEL). The River Ebi.
38. *Ctenogobius similis* (GILL).
39. *Ctenogobius kurodai* TANAKA.

TANAKA, SHIGEO, 1909: Notes on Fresh-water Fishes from the Province of Shinano, Japan. Ann. Zool. Jap., 7 (2), pp. 125–138.

The Province of Shinano is not very rich in species of freshwater fishes, lacking several species which are common in many other districts. The author finds out that *Cottus pollux* is very common, while the closely allied species *Cottus kazika* is entirely absent. *Leuciscus jouyi* and *L. hakuensis* live together. *Odontobutis obscurus*, *Fluvidraco ransonetti*, *Sarcocheilichthys variegatus* and certain other species are not represented in the material, but whether these are really absent or not needs to be determined by further observations. The author lists up 25 species with some notes.

WAKIYA, YÔJIRÔ and TOKUHISA, SANSYU, 1909: The Fishes of Shimane Prefecture (I), Ann. Zool. Jap., 4 (4), pp. 19–20. (in Japanese).

The authors listed up 18 species of marine and freshwater fishes obtained in Shimane Prefecture. Here we picked out the following freshwater fish.

1. *Gasterosteus japonicus* STEINDACHNER.
2. *Carassius auratus* LINN.
3. *Misgurnus anguillicaudatus* CANTOR.
4. *Lateolabrax japonicus* CUV. et VALLEN.

1910

FOWLER, HENRY W., 1910: Descriptions of four new *Cyprinoids* (*Rhodeinae*). Proc. Acad. Nat. Sci. Philadelphia, 62 (2), pp. 476–486.

In the present paper, he has described two species of *Acheilognathus* from Japan. One is *Acheilognathus lanceolatus* (SCHLEGEL) collected at Matsubara, Lake Biwa, Kurume, Katana and the other is *Ach. limbatus* (SCHLEGEL) from Nagoya, Tsuruga and Matsubara, Lake Biwa. He has established a new subgenus *Rhodeous* with *Acheilognathus brevianalis* collected at Matsubara of Lake Biwa as the type. He has also established a new genus *Hamigrammocypris* with *Hemigrammocypris rasborella* collected at Matsubara, Biwa Lake, as type species. This genus is related to *Rasbora*, but differs in the incomplete lateral line. It also differs from *Zacco* and *Opsariichthys* in the same character, besides others, such as the larger scales, etc.

JORDAN, D. S. and RICHARDSON, R. E., 1910: A Review of the Serranidae or Sea-bass of Japan. Proc. U. S. Nat. Mus., 37 (1714), pp. 421–474.

The author made a revision of Japanese Serranidae found in the waters of Japan. The specimens were obtained from Japan by JORDAN and SNYDER in 1900. In his report only one freshwater fish *Brythosus kawamebari* (T. et SCH.) was described. It is abundant in clear streams and mountain springs. They collected specimens from Yana River and Yabe River, near Funayado, Kyûshû.

KOSHIDA, TOKUJIRO, 1910: Spawning Marks on the Scale of *Oncorhynchus masou* BREVOORT. Suisan Ken-kyûshi, 5 (4), pp. 75–77. (in Japanese).

It is a question whether *Oncorhynchus masou* BREVOORT spawns only one time in all his life or it spawns every year. The author discovered a spawning mark on the scale of a three year fish caught at Marunuma, Tone-gun, and Gummagun, in Gumma Prefecture. Among the 30 individuals of 2 or 3 years old are found to have spawning marks. He supposes that the trout at Marunuma will spawn twice in his life.

KOSHIDA, TOKUJIRO, 1910: Notes on "Kunimasu." Suisan Ken-kyûshi, 5 (5), pp. 100–109. (in Japanese).

„Kunimasu" is one of the trout found in Lake Tazawa, Senhoku-gun, Akita Prefec ure. The systematic position was not determined by the previous investigators. KITAHARA, TASAKU recognized the present fish as a land locked form of *Oncorhynchus kisutch* WALBAUM while the authorities of Akita Prefecture Fisheries Experimental Station thought it may be *Oncorhynchus masou* BREVOORT, somewhat changed by the enviroment. The author has studied the outer and skeletal features of three females and two males. He has also compared them with three species of Japanese trouts and concluded the present species may be quite distinct from the others. He believed that the present species may be new to science.

NAKAMURA, MASAO, 1910: Freshwater Fishes from a Part of Niigata Prefecture. Zool, Mag., 22 (256), pp. 119–120. (in Japanese).

The author collected many freshwater fishes in and around Nagaoka City and made the following list.

1. *Lampetra japonica* (VON MARTENS). The River Shinano.
2. *L. mitsukurii* HATTA. The River Ogawa.
3. *Liobagrus reini* HILGENDORF. The River Shibuumi.
4. *Parasilurus asotus* (LINN.). ditto.
5. *Misgurnus anguillicaudatus* (CANTOR). The River Ogawa.
6. *Cobitis taenia* LINNAEUS. The River Ôta.
7. *Lefua echigonia* JOR. et RICH. A stream.
8. *Cyprinus carpio* LINNAEUS. The River Shinano.
9. *Carassius auratus* (LINNAEUS). ditto.
10. *Hemibarbus barbus* (SCHLEGEL). ditto.
11. *Pseudogobio esocinus* (SCHLEGEL). The River Shibuumi.
12. *Acheilognathus limbata* (SCHLEGEL). The River Shinano.
13, *Ach. lanceolata* (SCHLEGEL). ditto.
14. *Gnathopogon elongatus* (SCHLEGEL). A stream.
15. *Pseudorasbora parva* (SCHLEGEL). The River Ota.
16. *Leucgobio güntheri* ISHIKAWA. The River Uwono.
17. *L. jordani* ISHIKAWA. The River Kawasaki.
18. *L. hakuensis* (GÜNTHER). The River Shinano.
19. *L. taczanowskii* STEINDACHNER. ditto.
20. *L. dorobae* ISHIKAWA. The River Kaki.
21. *Anguilla japonica* SCHLEGEL. The River Shinano.
22. *Mesopus olidus* (PALLAS). ditto.
23. *Oncorhynchus keta* (WALBAUM). ditto.
24. *Salmo masou* (BREVOORT). The River Hama.
25. *Salvelinus malma* (BREVOORT). ditto.
26. *Plecoglossus altivelis* SCHLEGEL. ditto.
27. *Salanx microdon* BLEEKER. The River Shinano.
28. *Aplocheilus latipes* (SCHLEGEL). A stream.
29. *Gasterosteus cataphractus* (PALLAS). The River Ogawa.
30. *Pygosteus brevispinosus* ÔTAKI. The River Shimazaki.
31. *Hyporhamphus sajori* (SCHLEGEL). The River Shinano.
32. *Mugil haematochilus* SCHLEGEL. ditto.
33. *Lateolabrax japonicus* (C. et V.). ditto.
34. *Rheopresbe fujiyama* JOR. et STAR. The River Aga.
35. *Cottus kazika* JOR. et SNY. ditto.
36. *C. pollux* GÜNTHER. The River Uwono.
37. *Curyphopterus similis* (GILL). The River Shinano.
38. *Chaenogobius macrognathus* (BLEEKER). ditto.
39. *Chloea castanea* (O' SHAUGHNESSY). ditto.
40. *Ch. sarchynnis* JOR. et SNY. ditto.
41. *Acanthogobius flavimanus* (SCHLEGEL). ditto.
42. *Tridentiger obscurus* (SCHLEGEL). ditto.
43. *Leucopsarion petersi* HILGENDORF. The River Aoumi.

1911

HATTA, SABURO, 1911 : Über die Variabilität und den Dimorphismus des japanischen Neunauges. Ann. Zool. Jap., 7 (5), pp. 263–269.

The author treated many specimens from many localities of Japan. He distinguished three species of this genus: *Lampetra mitsukurii major*, *L. mitsukrii minor* and *L. japonica.* by the morphological characteristics.

IIDA, KENJI, 1911: Fighting Fish of Okinawa. Zool. Mag., 23 (273), p. 68. (in Japanese).

In the summer of 1911, the author traveled in Okinawa and heard about the habits of fighting fish. This fish is widely distributed all over the streams and rivers of Okinawa. It lives in calm, clear waters and during the winter it goes in the deeps. When the breeding season comes, he comes up shallow waters to make patches of bubbles on the surface of water. The breeding season occurs from the end of March to April. When he returned to Japan that year, he brought a pair, changing water three times in 6 days. They were puite healthy and tamed in an aquarium of warm house.

KOSHIDA, TOKUJIRÔ, 1911: The Hermaphroditism of Salmon and Trout. Suisan Ken-kyûshi, 6 (4), pp. 9–11. (in Japanese).

It is quite rare that we find hermaphroditic Salmonoid fish in Japan. The author records that Mr. MURAKAMI JIRÔ, a student of Fisheries High School, collected two hermaphroditic specimens of Salmon and "Karafuto Masu" in the down stream about 14–15 miles from City of Nikoli. One specimen of Salmon exhibits one pair of gonads; the left one consists of three parts, the upper is occupied by ovary, with a small bit of testis at the ventral side and the most part of the middle is occupied by testis, with a small testis at the tip of small ovary. While the small posterior is occupied by testis. The right side gonad consists of the two parts; the anterior one is occupied with ovary and the posterior by testis. The size of the gonads

The left side gonad	*Length*	*testian part*	*ovarian part*
	23.0 cm.	3.4 cm.	3.5 cm.
The right side gonad	2.9	2.7	37.5

The eggs are yellowish brown, measured 3–4 cm. in size; the sperm whitish, with light yellow. The gonad consists of one, exhibiting testis on the anterior and ovary on the posterior.

MATSUBARA, SHINNOSUKE, 1911: History of Salmon and Trout Cultures in Japan. Suisan Kôshûsho Hôkoku* (in Japanese).

The author mentioned the salmon and trout cultures in Japan by the following contents. 1. Historical sketches of salmon and trout culturing in Japan. 2. Species of salmon and trout and their economic value. 3. The present conditions of salmon and trout culture. Brook culture, Lake culture, Pond culture. 4. Conclusion.

In 1876, SEKIZAWA, SEIMEI tried the artificial hatching of salmon at Nakagawa, Ibaraki Prefecture. In 1887, the salmon hatcheries were established at Chitose, Iburi Province of Hokkaidô and the hatching works has continued to the present. In 1887, we transported the eggs of *Salmo irideus* from the United States of America into the hatchery at Shirakomura, Chûgûshi, Nikkô of Ibaraki Prefecture. After hatching out the young were feeding in Inawashiroko, Fukushima Prefecture. In Japan, there found 15 species and 7 genera of Salmonidae, two species of which were introduced from the United States of America. In 1902, the eggs of *Salvelinus fontinalis* were presented by the American Ambassador, MACDONALD, and transported to the Hatchery of Nikkô, Chûgûshi. After hatching out, the young were discharged into Yukawa, near Lake Chûgûshi Nikkô.

NISHIYAMA, IROKU and **ONIZUKA, MASAHARU,** 1911: On the *Plecoglossus altivelis* of the River Tama, Kumamoto Prefecture. Suisan ken-kyûshi 10 (4), pp. 187–189. (in Japanese).

The authors make the general observations on *Plecoglossus altivelis* in Kumamoto Prefecture.

1912

HORIKAWA, YASUICHI, 1912: Observations of *Gasterosteus cataphractus*. Zool. Mag., 24 (419), pp. 418–420. (in Japanese).

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* Suisan Kôshûsho Hôkoku = Report of the Fisheries Research Institute, Tôkyô. attached to the Fisheries Department of Ministry of Agriculture and Forestry.

The author observed on the breeding habits of this fish at the River Hiroe, Kanô-machi, Gifu City, Gifu Prefecture, on February 20th of 1911.

The number of eggs contained in a female ranges from 30 to 368, according to the size of the fish. The diameter of eggs 2 mm; one female may deposit 50–60 eggs in one time and two or more females spawn in one nest. The eggs hatch out in one or two days.

KANEKO, MASANOSUKE, 1912: Natural State of *Plecoglossus altivelis* after hatching out, Suisan-Ken-kyûshi, 7 (1), pp. 5–10. (in Japanese).

The author mentioned the habit of *Plecoglossus altivelis* after the hatching out. He observed this fact at the River Takatsu, Shimane Prefecture during November 6th and 9th, 1912. He was astonished that the mortality is unrespectably high after the hatching out. He thought that the newly hatched young is better to enter the sea the sooner, not to stay longer. If the spawning ground is far from the entrance of river, the youngs will take a long time to descend the river and die. The best spawning ground is situated near the mouth of a river, near the sea.

MATSUNO, SUKEKICHI, 1912: Fishes of Prefecture Toyama. Suisan Ken-kyûshi 7 (8), pp. 248–251. (in Japanese).

There are 94 species of fish in Toyama Prefecture, of those which the following freshwater species are listed by the author. *Oncorhynchus masou*. *Oncorhynchus keta*, *Cyprinus carpio*. *Gasterosteus cataphractus*, *Leuciscus hakuensis*, *Carassius auratus*. *Plecoglossus altivelis*, *Salanx microdon*, *Aplocheilus latipes*, *Hypomesus olidus*.

SNYDER, J. O., 1912: Japanese Shore Fishes collected by the United States Bureau of Fisheries Steamer "Albatross" Expedition of 1906. Proc. U. S. Nat., vol. 42, pp. 399–450, pls. 51–61.

The present report included the large collection of shore fishes obtained in Japanese by the United States Bureau of Fisheries Steamer Albatross Expedition of 1906. Localities of the collection were mostly Hakodate, Muroran, Otaru in Hokkaidô and Same, Aomori, Aikawa, Misaki, Shimizu, Kagoshima, Akune and Tanegashima Island. Here we have listed only the freshwater fishes.

1. *Entosphenus japonicus* (von MARTENS). A small specimen collected at Yamaguchi.
2. *Lampetra planeri* (BLOCH). Young specimen from the Ishikari River, Sapporo.
3. *Acipenser mikado* HILGENDORF. Specimens bought at Otaru and a Hakodate fish markets.
4. *Plecoglossus altivelis* T. et SCH. Specimens bought at Tôkyô and Tsuruga fish markets.
5. *Osmerus dentex* STEINDACHNER. Specimens bought at Tomakomai, Hakodate, and Muroran fish markets.
6. *Mesopus olidus* (PALLAS). Specimens bought at Mori, Tomakomai, and Hakodate fish markets.
7. *Parasilurus asotus* (LINN.). Tôkyô fish market and Takamatsu River, Akune.
8. *Liobagrus reini* HILGENDORF. Yamaguchi.
9. *Misugrnus anguillicaudatus* (CANTOR). Hakodate and Tôkyô fish markets; Takamatsu River, Akune.
10. *Cobitis taenia* LINNAEUS. Nanao and Yamaguchi.
11. *Orthrias oreas* JORDAN et FOWLER. The Ishikari River, Sapporo, Hokkaidô.
12. *Carassius auratus* (LINN.). Niigawa; Same; the Takamatsu River, Akune; Yamaguchi, and Dôgo Island (?).
13. *Hemibarbus barbus* (T. et SCH.). Tôkyô.
14. *Leucogobio mayadae* (J. et SNY.). Yamaguchi.
15. *Pseudogobio esocinus* (T. et SCH.). Yamaguchi.
16. *Zezera hilgendorfi* (ISHIKAWA). Yamaguichi.
17. *Acheilognathus lanceolatum* (T. et SCH). Yamaguchi.
18. *Ach. limbatum* (T. et SCH.). Niigawa (?); Yamaguchi.
19. *Zacco platypus* (T. et SCH.). The Takamatsu River, Akune.
20. *Zacco temmincki* (T. et SCH.). Yamaguchi.

21. *Richardsonius hakuensis* (GÜNTHER). Otaru fish market; Sapporo; Tomakomai; Hakodate fish market; Niigata ?; Same; Aikawa; Dôgo Island.
22. *Oryzias latipes* (T. et SCH.). Shiogama; Yamaguchi; Akune; Nanao, and Dôgo.
23. *Gasterosteus cataphractus* (PALLAS). Tomai.
24. *Pygosteus tymensis* (NIKOLSKY). Sapporo and Tomakomai.
25. *Ctenogobius similis* (GILL). Aikawa and Yamaguchi.
26. *C. hadropterus* JORDAN et SNYDER. The Takamatsu River. Akune; Shimonoseki; Tanega-shima.
27. *Aboma lactipes* (HILGENDORF). Tomakomai, Same, Niigata ?, Shiogama and Aikawa.
28. *Aboma snyderi* JORDAN et FOWLER. Shiogama.
29. *Chaenogobius macrognathus* (BLEEKER). Tomakomai, the Takamatsu River, and Akune.
30. *Chloea castanea* (O' SHANGHNESSY). Nanao, Same, Aikawa, Shiogama, and Dôgo.

TANAKA, SHIGEO and KASAI, TAKAJIRO, 1912: A List of Freshwater Fishes found around Wakiya-cho, on the River Yoshino, Tokushima Prefecture. Zool. Mag., 24 (290), pp. 719-721. (in Japanese).

Mr. KASAI, TAKAJIRO one of the authors, collected the specimens himself and Dr. TANAKA, SHIGEO identified them with as follows.

1. *Lampetra planeri* BLOCH.
2. *Oncorhynchus masou* (BREVOORT).
3. *Plecoglossus altivelis* (T. et SCH.).
4. *Parasilurus asotus* (LINN.).
5. *Fluvidraco nudiceps* (SAUVAGE).
6. *Liobagrus reinie* HILGENDORF.
7. *Misgurnus anguillicaudatus* (CANTOR).
8. *Cobitis biwae* JORDAN et SNYDER.
9. *Hemibarbus barvus* (T. et SCH.).
10. *Leucogobio esocinus* (T. et SCH.).
11. *Richardsonius hakuensis* (GÜNTHER).
12. *Zacco platypus* (T. et SCH.).
13. *Zacco temmincki* (T. et SCH.).
14. *Cyprinus carpio* (LINN.).
15. *Pseudorasbora carpio* (T. et SCH.).
16. *Pseudorasbora parva* (T. et SCH.).
17. *Carassius auratus* (L.).
18. *Anguilla japonicus* T. et SCH.
19. *Oryzias latipes* (T. et SCH.).
20. *Mugil cephalus* LINN.
21. *Lateolabrax japonicus* (C. et VAL.).
22. *Cottus kazika* JOR. et STAR.
23. *C. pollux* GÜNTHER.
24. *Rhinogobius similis* GILL.
25. *Tridentiger obscurus* T. et SCH.
26. *Chenogobius macrognathus* (BLEEKER).

1913

AOKI, TAKAO, 1913: Fishes found in the Vicinity of Uchiura-Mura, Takata-Gun, Shizuoka Prefecture. Gyogaku Zasshi*, 1 (5), pp. 11-12. (in Japanese).

The list of seven freshwater fishes and notes on their habits are given.

1. *Oncorhynchus masou.*
2. *Misgurnus anguillicaudatus.*
3. *Richardsonius jouyi.*
4. *Cottus pollux.*
5. *Cobitis taenia.*
6. *Lefua echigonia.*
7. *Squalidus güntheri.*

HIGURASHI, TADASHI, 1913: Comparison of Body Length of *Plecoglossus altivelis* of the River Tama and Lake Biwa. Suisan Ken-kyûshi, 8 (4), pp. 163-166. (in Japanese).

The size of the adult of this fish shows a great difference with the rivers. The fish of the River Tamagawa, Higo Province is very large while that of the River Tama, Tôkyô very small. Such results may come from the size of river and the amount of food in the river. He measured two differnt types of *Plecoglossus altivelis*, one is caught at the River Tama, Tôkyô and the other is from Lake Biwa. He measured some 200 specimens *Plecoglossus altivelis* at the spawning ground, Futagomura, Tôkyô, on December 5, 1912; the male 171 specimens and female 27 specimens, 15 cm. body length of both sexs,

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* Gyogaku Zasshi = Ichthyological Magazine published by Dr. SH. TANAKA, Tôkyô.

which is the common size of this fish at the River, Tôkyô. He also measured the *Plecoglossus altivelis* of Lake Biwa. He took 159 females and 213 males and measured, and concludes that the male occupied 7.4-7.7 cm. in body length and the female 7.3-7.4 cm.; the male is somewhat larger than female. It is necessary to measure many specimens in different localities to know the relationship between the size of the fish and the length and condition of various rivers and lakes.

HIGURASHI, TADASHI, 1913: Notes on the German Carp transported into Japan. Gyogaku Zasshi, 1 (3), pp. 54-55. (in Japanese).

The German carps were introduced by the courtesy of Mr. HOFFER, the Professor of München Veterinary School in 1904 to present them to Mr. MATSUBARA, SHINNOSUKE, the head of the Tôkyô Fisheries College. They were fed in the pond of the fish culture branch of the College at Huyuki-chô, Fukagawa-ku, Tôkyô and have been breeding since 3 years after their arrival. They were extended to the freshwater areas of Japan when they have shown considerable variation. The variety exhibits the characters of hybrids between the Japanese proper carp and the introduced German carp by inter ding. bree

HIKITA, TOYOHARU, 1913: On a New Species *Osmerus attenuatus* belonging to Argentinidae of Japan. Zool. Mag., 25 (293), pp. 127-129. (in Japanese).

The author collected an interesting species belonging to Argentinidae, from the River Mukawa, Iburi Province, Hokkaidô. It is distributed in the rivers and brackish waters of the eastern coast of Hokkaidô. This new species, *Osmerus lanceolatus* n. sp. closely resemble *Osmerus attenuatus* LOCKINGTON but is different from it in the number of fin rays, the number of scales and the teeth form. In November and December of the year, the fish ascends the river during night and spawns eggs in shallow sandy places. It takes about 10 days for it to arrive the spawning ground and after sexual actions it descends into the sea.

JORDAN, D. S., 1913; Description of *Anguilla manabei*, a New Eel from Japan. Proc. U. S. Nat., 44, pp. 359-360.

He described a new eel *Anguilla manabei* from a specimen collected by Mr. YOSHIO MANABE, one of the student of Kansai Gakuin in Kôbe. The author remarked the difference between common eel, *Anguilla jaopnica* and the present *Anguilla manabei* in having larger head, longer jaws and smaller pectoral fins and eye. Moreover, it remarkably differs in the backward insertion of the dorsal fin which measured not more than of head length in front of the vent.

KANEKO, MASANOSUKE, 1913: Pros or Cons on the Encouragement of German Carp Breeding. Gyogaku Zasshi, 1 (1), pp. 22-23. (in Japanese).

The author discussed pros or cons on the breeding of German carp which are beneficial to the Japanese freshwater fisheries. The German carp has a characteristic of more rapid growth than the Japanese carp and colder endurance. From these characters, he pointed out that the German carp is suitable to breed in the cold waters of Japanese and the Japanese carp to breed in warmer district.

KAWAKAMI, SAIJI, 1913: Fishes from Kumamoto. Gyogaku Zasshi, 1 (4), pp. 15-19, June 1, 1913. (in Japanese).

The author listed 129 species of marine and freshwater fishes collected from Kumamoto market, Ariake Sea and their vicinity. The freshwater fishes are *Pseudorasbora parva*, *Parasilurus asotus*, *Carassius*, *auratus*, *Acheilognathus lanceolatus*, *Zacco platypus*, *Paracheilognathus rhombeum*. Beside these two freshwater fishes, 6 *Gobius* and *Bryttosus kawamebari* are described.

KURODA, NAGAMICHI, 1913: Notes on the local Names of Fishes. Gyogaku Zasshi, 1 (2), pp. 10-12. (in Japanese).

He has investigated the local names of marine and freshwater fishes in the Kantô district. Two of the freshwater fishes *Pseudogobio esocinus* and *Zacco platypus* are completed. *Pseudogobio esocinus* "Kamatsuka" is called "Donchi" in Arakawa Tôkyô, and *Zacco platypus* "Oikawa" is called Iwana in Arakawa, Tôkyô.

MARUKAWA, HISATOSHI, 1913: Notes on the *Leptocephalus unagii* n. sp. of Japanese Eel. Gyogaku Zasshi, 1 (3), pp. 5–9. (in Japanese).

In 1912, (12 of April), Mr. Y. KOBAYASHI, a member of the Tokushima Fisheries Experimental Station, collected at Hiwasa, Umibe-gun, Tokushima Prefecture, three young eels by the sardin trawl net. The specimens measured 138, 130.5, 112 mm. body length, and the number of myomeres 116, 116, 118. Compared with European *Leptocephalus*, the present specimens are larger and show the presence of black pigments on the lateral sides and both margins of the dorsal and ventral fins. From these differences, the author identified the specimens as the young of *Anguilla japonica* and called them *Leptocephalus unagii*. The collecting ground is located off Hiwasa Machi, with grey sands, 17–18 hiro in depth, a few miles off the coast. The depth may be about 100 hiro several miles from the coast.

MATSUBARA, SHINNOSUKE, 1913: German Carp. Suisan Ken-kyûshi, 8 (2), pp. 29–30. (in Japanese).

The author reports that when in München, Germany, he visited Dr. B. HOFFER to confer with, the varieties of German carp, Mirror carp and Lether carp, to be introduced into Japan from Germany during 1903. In 1905, when Dr. DOFLEIN came to Japan, he brought 30 fishes with him. But unfortunately only 7 individuals survived and they put them into the fish culture ponds at Fukagawa attached to the Fisheries Institution. In the next spring he divided them to spread over the different localities.

MATSUURA, KANICHIRÔ, 1913: Notes on *Anguilla mauritiana* "(Taunagi)" founded in Tôkyô. Gyogaku Zasshi, 1 (4), pp. 86–87. (in Japanese).

In June of 1912, *Anguilla mauritiana* was caught in culture pond by Mr. SHINOZO, SASAKI, a goldfish dealer at Taitô-ku, Tôkyô. He presented this specimen to Ueno Zoo. The author described the specimen and noted that this species has a lot quantity of blood in the body.

MATSUURA, KANICHIRÔ, 1913: Freshwater Fishes (1). Gyogaku Zasshi, 1 (1), pp. 12–13. (in Japanese).

General descriptions of freshwater fishes found in Japan. The author described the local names and the distribution of *Bryttosus kawamebari* (TEMM. et SCH.) "Kawamebaru". The distributional range is located in the northern district of Kinai, indicating the eastern limit. It is found abundantly in Mimasaku and in Chikugo, Hizen of Kyûshû in the west. He pointed out the mistake of the description by SIEBOLD in Fauna Japonica, that the present species is a marine fish and represents *Serranus hepatus* found in the Miditerranean Sea. GÜNTHER also mentioned in his catalogue of fishes of the British Museum that the present species is found in the Sea of Japan. According to his observations, the present species does not live in the main river but is found in the littorals of the river branches.

MATSUURA, KANICHIRÔ, 1913: Freshwater Fishes (2). Gyogaku Zasshi, 1(2), pp. 34–35. (in Japanese).

He noted the local name and the distribution *Ischikauia steenackeri* (SAUVAGE) "Wataka". This fish is an endemic species found in Lake Biwa and Seta River and Ogura Ike, Yamashiro. The notes of the habits was mentioned in "Kogyoko" by Mr. KOBAYASHI, at Zeze in the age of Bunka (1861). According to his description, the female has eggs in April and spawns from May to the end of June. Maleis more abundant than male. In the rainy season, they enter the rice field along the lake. We called them "Sôgyo" a grass eating fish. The author heard that so called "Umauo", horse-fish feeds in

the pond of a temple in the vicinity of Eikyuji, Nara Prefecture. He observed that a priest feeding on the fishes by horse-tail in the pond. From this fact, they call the fish as horse-fish.

NAMIYE, MOTOKICHI, 1913: The Key of the Species and Genera of the Salangidae., Zool. Mag., 25 (300), pp. 534–536. (in Japanese).

The author translated the report of C. TATE REGAN about the key of Salangidae into Japanese. In this key we found two species: *Salangichthys microdon* (BLEEKER) from Yedo (by BLEEKER) and Yokohama (by CHALLENGER) and *Salanx ariakensis* KISHINOUYE from Ariake Sea, Kyûshû.

TANAKA, SHIGEO, 1913: Notes on Taunagi *Fluta alba* (ZUJEW) in the moat of Nijô, Kyôto City. Gyogaku Zasshi, 1 (1), pp. 17–18. (in Japanese).

He observed a specimen of *Fluta alba* send by the Shimazu Company, and collected at the most of Nijo, Kyôto City on the middle of August, 1912, and described that the present species has not been found as far as north Tôkyô. The fish is well adapted to its environment.

TOKUHISA, SANSHU, 1913: *Oncorhynchus kisutch* (WALBAUM) found in Noto. Suisan Ken-kyûshi, 8 (10), pp. 439–440. (in Japanese).

The author finds out that the silver salmon is distributed further down to the south of Japan, hitherto known in the preceeding paper. He finds out a specimen in a fish-storehouse at Udezu-machi, Noto, Ishikawa Prefecture in February of 1912. He measured all parts of the body and identified it as *Oncorhynchus kisutch* (WALBAUM) which had never been discovered except in the Kamtchatka Peninsula, Karafuto and Niigata on the coast of the Japan Sea in Japan.

YANAMOTO, TOSHIO, 1913: Eggs and Embryos of Freshwater Fishes in Japan. Suisan Ken-kyûshi, 8 (11), pp. 490–500. (in Japanese).

The author made observations in the eggs and embryos of freshwater fishes found in Lake Biwa, Lake Mikata and several lakes of Ibaraki Prefecture.

1. *Oryzias latipes*: Eggs spherical, 1.2 mm in diameter, with hexagonal patterns, having hairs like processes, ten of them longer and thread-like, making a bundle and the others shorter, curved at the end. An embryo just hatching out 4.5 cm. with 27 myotomes, with large oil globule somewhat smaller than eye. It attains the size of the adult in about 30 days.

2. *Pseudorasbora parva*: Eggs are somewhat elliptical, 2–2.5 mm. without oil globule. The egg membrane gelatinous is somewhat rather thick. An adult measured 9 cm. has 300 eggs, and deposits about ten or mores in several times. In natural, eggs are attached to the water plants in about 60 cm. deep. The hatching out embryo is about 2 cm. with a large yolk sac and with 36 myotomes. In four or five days, the embryo has already absorbed the yolk sac and takes diatomes and copepods.

3. *Acheilognathus sp*: The egg may be the largest among all the freshwater fishes except for Salmonids group. It is elliptical, measured 3.9×1.8 mm in size, deep yellow, egg membrane very thin, intransparent, without oil globules. The eggs are deposited in the branchial chamber of freshwater bivalves. He examined several bivalves on April 19th, 1913 in the offing Kakezaki, Kitaura (about 3 meters deep and muddy bottom). He took 40 individuals of "Tankai" and 48 of "Darumagai". From these bivalves, he found the following eggs of each bivalve.

a. Shell length of "Tankai" (*Cristaria plicata spatiosa* (CLESSIN) ...... 15.9cm; Number of eggs of *Acheilognathus* 6 eggs.

b. Shell length of "Darumagai" (*Anodonta* sp.)......7.5cm, 8.4, 9.0, Number of eggs of *Acheilognathus* 14, 23, 16 Haching embryo measures 11 mm. compressed bilaterally with 30 myotomes.

4. *Parasilurus asotus*: He often observed a natural spawning. On May 6 of 1912, he found many eggs attached to a weed ("Hozakino fusamo"). That eggs are somewhat larger than those of a carp, cubical, 1.4 mm in diameter and the egg membrane is somewhat thicker, attaching to weeds. Before hatching out, the melanophores are well developed and the embryo looks like very black. The just hatching out embryo measures 6.3 mm, with 55 somites and very small yolk sac. The black chromato-

phores are distributed numerously on the back and belly, and light yellow on the dorsal and cervice.

5. *Hemirhamphus sajori*: The eggs cubical measure 1.8 mm in diameter, somewhat thick, providing with numerous pores. The surface of the membrane has many transparent, elastic strings composing many of them to make a main bundles to attach weeds. The breeding season may cover from May to August. The number of eggs deposited is about 200. He had many occasions to see the natural spawning. One case occurred on June 9th of 1913, about 320 meters in the offing of Kitaura, it is about 1 meter deep, where many "Senninmo" weeds were planted to which the eggs are to be attached.

6. *Tridentiger obscurus*: The eggs is small; the one end is narrow and the other end broader as is the egg of a chicken. It measures 0.6 × 0.48 mm. with oil globule. The egg membrane is thin, covered with slender strings which resemble those of *Salangichthys microdon*. Hatching embryos are small, measured 3mm, with 25 myotomes. The breeding season is June and August. The eggs in an adult fish are 300–800 in number in the adults of the Kasumigaura and 600–1400 in the adults of Hishinuma, Ibaraki Prefecture.

7. *Rhinogobius similis*: The eggs resemble with those of *Tridentiger obscurus* but are somewhat longer, 0.66 × 0.45 mm. The strings on the surface of eggs are very thin and slender. The breeding season occurs from the middle of May to the end of June. The number of deposited eggs is 300–1,000 mostly 4,500 in average.

8. *Salanx microdon*: The eggs are cubical, measured 6 mm. in diameter, without oil globule. The egg membrane is very thin and 18–25 strings are arranged regularly in radical lines on the surface of an egg. These strings are composed into a bundle to attach itself to such weeds as "Shakujimo" and "Himehotarui", in Kasumigaura and Kitaura and to pebbles and stones in Hishinuma, Ibaraki Prefecture. The deposited eggs are about 300–800 in Kasumigaura, Kitaura and Hishinuma. The breeding season continues from the middle of March to the beginning of May.

9. *Hypomesus olidus*: The egg is cubical, resembling that of *Plecoglossus altivelis*, measured 6 mm. in diameter. Two egg membranes exist, the outer one to be attached to other substrata. In Lake Mikata, the fish spawns on the sandy and pebbly bottom while in Kasumigaura, Kitaura, Kamiike, Akogigaura of Ibaraki Prefecture the fish deposits eggs on weeds along the coast. The deposited eggs vary in number; in the adult fish measured 14 cm. about 12,000, while in the 2nd year adult fish measured 8.4cm are 3000–7000 eggs. The spawning season begins at the end of January and continues to the middle of March. The hatching out embryo is about 6 mm, resembles *Plecoglossus altivelis*, with 58 myotomes, with elliptical yolk sac. Ten days after the spawning, the embryo absorbes the yolk sac.

10. *Plecoglossus altivelis*: The egg is cubical, measured 7.8mm in diameter, the outer egg membrane attaching to substratum. The deposited eggs are about 1400–3800 in number. The breeding season occurs from the beginning of September to the end of October. It hatches out in 13 days when the water temperature is 12°C. The hatching out embryo is 6mm. in body length. The yolk sac is elliptical, with 48 myotomes.

WAKIYA, YOJIRÔ and **TAKAHASHI, NISUKE,** 1913: Salangidae of Japan. Zool. Mag., 25 (301), pp. 551–555. (in Japanese)

The authors reported chiefly on the constitution of egg membrane of every species of this family. The characteristics are quite different in every species and easily distinguishable in many species found in Japan.

1. *Salangichthys microdon* BLEEKER: Egg diameter about 0.7 mm; egg membrane filaments number 16–20 on the whole. Distribution—Tôkyô Bay; Kasumigaura; Kuwana (Mie Prefecture); Akita Prefecture; Ishikawa Prefecture.

2. *Salangichthys kishinouyei* n. sp.: Egg diameter about 0.6 mm; egg membrane is roughly filamentous; filaments 16–18 in number, scarcely branched and somewhat broad, 21 mm. broad in the middle, often making net-work. Distribution—very abundant in Matsuye, Shimane Prefecture.

3. *Salangichthys ishikawae* n. sp.: Egg diameter 0.95 mm; egg membrane is quite different from

the specimens above. It is a membrane which covers nearly half the egg, around the micropyle. Eight pores around the micropyle are arranged like a chrysanthemum flower. On the other entire remaining space, many small pores are distributed. In every pore, there are many striations radiating from its center. Distribution—Tonami Mangokuura, Miyagi Prefecture, Mikawa, Shizuoka Prefecture; Tôkyô Bay.

4. *Parasalanx ariakensis* KISHINOUYE: Egg diameter is 0.75 mm. Egg membrane is filamentous, radiated from the micropyle, numbered 11–14. The filament slender, about 9μ in breadth. Distribution–Ariake Bay, Kyûshû.

5. *Salanx cuvieri*: The authors found this specimen in the bottle of specimens of *Salanx microdon.* The accurate distribution is not yet known.

1914

ISHIKAWA, CHIYOMATSU and TAKAHASHI, NISUKE, 1914: Note on the Eels of Japanese, Korean, Formosan and Adjacent Waters. Jour. Coll. Agr. Imp. Univ. Tôkyô, 4 (7), pp. 415–433.

As the idenification of the species of *Anguilla* occurring in the Japanese waters appears to be in great confusion, the author made a closer examinations of a number of specimens from Japan and adjacent waters. *Anguilla japonica* is the most common, occurring in all waters of Honshû facing the Pacific Ocean, Shikoku and Kyûshû, and Hokkaidô. On the Japanese Sea side of Honshû it occurs only in waters flowing to the sea far west of the Noto Peninsula. *Anguilla mauritiana* occurs in the waters of the middle and southern parts of Japan, being found in all Seven Islands of Izu as stragglers from the tropical seas.

KAWAI, TATEMARU, 1914: *Salangichthys microdon* in Lake Matsue. Suisan Ken-kyûshi, 9 (1), pp. 5–12. (in Japanese).

The author reported on the habits of *Salangichthys microdon* in Lake Matsue, Shimane Prefecture. The breeding season is changeable with the year, mostly covers from the beginning of March to the end of May. The breeding grounds spread from off Raiji-mura, the southern coast of Lake Shinji to the western coast of Shinji-machi. This fish ascends the River Ôhashi from Nakanoumi into Lake Shinji and descends from Lake Shinji to Nakanoumi. This fish deposits the eggs on weeds, mostly "Sasamo"; when the embryos hatch out, they stay in the spawning grounds and move shoal off Shinji-machi. In August a migration to the sea occurs.

MATSUURA, KANICHIRO, 1914: Freshwater Fishes (3). Gyogaku Zasshi, 1 (4), pp. 90-91. (in Japanese).

Opsariichthys uncirostris TEMM. et SCH. "Hasu". The distribution is nearly the same as that of *Ischikauia steenackeri* (SAUVAGE), mostly in Lake Biwa, Seta River, and Ogura pond but also in the Kansaki River, a branch of Yodo River and Lake Mikata, Wakasa.

TANAKA, SHIGEO, 1914: List of Representative Fishes of Japan Proper. 3rd ed. (published by himself). pp. 1–21. (in Japanese).

The writer selected representative fishes of Japan proper including the following freshwater fishes.

1. *Anguilla mauritiana.*
2. *Lampetra planeri.*
3. *Oncorhynchus masou.*
4. *Plecoglossus altivelis.*
5. *Hypomesus olidus.*
6. *Parasilurus asotus.*
7. *Misgurnus anguillicaudatus.*
8. *Acheilognathus lanceolatus.*
9. *Hemibarbus barbus.*
10. *Gnathopogon elongatus elongatus.*
11. *Pseudogobio esocinus.*
12. Colord *Cyprinus carpio.*
13. *Tribolodon hakuensis.*
14. *Zacco platypus.*
15. *Cyprinus carpio.*
16. *Carassius auratus.*
17. *Aplocheilus latipes.*
18. *Mugil cephalus.*

19. *Lateolabrax japonicus*
20. *Cottus kagika*
21. *Mogrunda obscura*
22. *Gobius similis*
23. *Tridentiger obrcurus*

1915

AMEMIYA, IKUSAKU, 1915: A fishing Method for *Leucopsarion petersi* HILGENDORF. Suisan Gakkaihô,* 1 (2), pp. 176–180, fig. 1. (in Japanese).

The author mentioned for catching *Leucopsarion petersi* HILGENDORF carried out in the Nitta River, Soma, Niigata Prefecture. *Leucopsarion petersi* is a small, translucent anadromous fish, somewhat allied to *Salanx* in habits. The fish usually run up river during the latter half of May to the end of June. The fishermen make a small dam in the shallow water of the river to make a small waterfall. From here, they make narrow canals with bamboo traps at their ends. The present fishery is primitive but rather interesting to use for a new method of catching of other anadromous fishes.

FUJITA, TSUNENOBU, and **WAKIYA, YÔJIRÔ,** 1915: A Catalogue of Fish in Kishû. Suisan Gakkaihô, 1 (1), pp. 25–37. (in Japanese).

During the stay at Tanabe-machi, Wakayama Prefecture, the authors examined the 180 fish specimens obtained in this prefecture. Here, we pick out the following freshwater fishes only.

Plecoglossus altivelis SCHLEGEL.
Parasilurus asotus (LINN.).
Cobitis sinensis SAUVAGE.
Richardsonius hakuensis (GÜNTHER).
Carassius auratus (LINNAEUS).
Anguilla japonica (SCHLEGEL).
Oryzias latipes (SCHLEGEL).
Lateolabrax japonicus (CUVIER et VALENCIENNES).
Tridentiger obscurus (SCHLEGEL).
Rhinogobius similis GILL.
Oncorhynchus masou (BREVOORT).
Misgurnus anguillicaudatus (CANTOR).
Richardsonius jouyi (JORDAN et SNYDER).
Zacco temmincki (SCHLEGEL).
Cyprinus carpio LINNAEUS.
Anguilla mauritiana BENNET.
Mugil japonicus SCHLEGEL.
Acanthogobius flavimanus (SCHLEGÉL).

KANEKO, MASANOSUKE, 1915: On the *Plecoglossus altivelis* of the River Nagara. (I–III). Suisan Ken-kyûshi, 10 (4), pp. 180–187; 10 (4), 215–226: 10 (4), 239–255. (in Japanese).

The author makes observations on the spawning habits at Kagamishima, the River Nagara, Gifu Prefecture. He has some plans for the fisheries of the River Nagara in his survey there.

KOKETSU, RIICHIRO, 1915: Notes on the Fading of Gold-fish. Zool. Mag., 27 (317), pp. 125–130; 27 (318), pp. 7–14; 27 (319), pp. 17–23. (in Japanese).

The author studied the fading of gold-fishes in the geological laboratory of Kyushû Univ. and published his results in three parts. He has treated the color and color changes; fading function, the appearance of melanophores; nature of melanophores, activity of phagocytes, distribution and development of phagocytes with melanin, injection experiments; changes in lipochrome and fading function, and other fishes. He concluded his result in the third part of the paper as follows.

1. The color of gold-fish is based on the existence of melanophores and xanthophors as well as guanin crystals.

2. The fading is due to the breaking of the pigment cells and the activity of phagocytes. The phagocyts along with pigments which are released from the broken cells in the skin move chiefly into the epidermal tissues and are cast off from the skin. The internal pigments are excreted from the body

* Suisan Gakkaihô = Fisheries Bulletin published by the Fisheries Institute, Tôkyô Imperial University, Tôkyô.

by the alimental and excretory organs. The rest found in the connective tissues and lymphatic tissues, gradually disappears by chemical action.

MATSUURA, KANICHIRÔ, 1915: Freshwater Fishes (4). Gyogaku Zasshi, 1 (5), pp. 118–121. (in Japanese).

Zacco platypus (SCHLEGEL). "Oikawa".

Gives the local name and the distribution of the present species. The distribution is limited to the far west of Musashi, Shinano of Honshû, and Kyûshû and Shikoku, Edo River, Tôkyô; Lake Suwa, Shinshû; Iruka pond, Owari; Inuyama, Owari; Fushimi, Mion; Inben River, Ise; Yoshino River, Yamato; Seta River, Omi: Ogura Pond; Yamashiro. *Zacco temmincki* (SCHLEGEL). "Kawamutsu"

The distribution is limited to Owari, Mino, Omi, Ise, Shikoku and Kyûshû (rather doubtful in the latter districts). The author collected this species at Iruka Pond, Owari; Fushimi, Owari; Seta River, Omi; Inbe River, Ise, and Ogura Pond Yamashiro. *Richardsonius jouyi* (JORDAN et SNYDER) "Tarobaye".

The present species lives mostly in the high land of Kai, Shinano, Hida, Mino, Omi, Iga, Misaku and Tsushima. He collected a specimen at Oshiro River, Daigahara, Kai Province, Inbe River, Ise; Miya River, Suwa, Shinano; Lake Nojiri, Shinano; Yabuhara, Shinano; Miya River, Hida; Takahara River, Hida.

TAKAHASHI, NISUKE, 1915: Notes on *Anguilla mauritiana* BENNETT. Journ. Coll. Agric. Imp. Univ. Tôkyô,* 6 (2), 193–197.

The writer describes a specimen called "Kanikui from the Bonin Islands with Dr. ISHIKAWA.** It is found frequently in the rivers and streams of the middle and southern parts of the main island of Japan. The writer minutely observed twice and confirms the specimen must be identified with *Ang. mauritiana* of southern waters and distinguished from *Ang. japonica.*

TOKUHISA, SANSYU, 1915: Pisces, Cephalopods and Molluscs of Ishikawa Prefecture. Suisan Kenkyûshi, 3 (10), pp. 119–132. (in Japanese).

The author listed the marine and freshwater fish of Ishikawa Prefecture which is on the Japan Seaside of Honshû. Here we picks out the freshwater fishes only,

1. *Entosphenus japonicus* (MARTENS).
2. *Lampetra planeri* (BLOOCH).
3. *Oncorhynchus nerka* (WALBAUM).
4. *O. keta* (WALBAUM).
5. *O. kisutch* (WALBAUM).
6. *O. masou* (BREVOORT). Breeding season occurs from August to September.
7. *O. kundscha* (PALLAS).
8. *Salvelinus malma* (WALBAUM).
9. *Plecoglossus altivelis* T. et SCH. Breeding season is October. The River Tetori, the River Daisyoji, the River Sai, the River Asano.
10. *Salangichthys microdon* BLEEKER. This fish was introduced into the lake of Kahoku from other districts by Mr. MAEDA during 1615–1643; WAKIYA and TAKAHASHI identified this fish of the lake of Shinji with *S. kishinouyei.* Perhaps *Salanx microdon* has not yet been introduced into Lake Shinji and perhaps *S. kishiuouyei* was existing before the introduction.
11. *Parasilurus asotus* (LIN.). Breeding season is May to June.
12. *Misgurnus anguillicaudatus* (CANTOR) Breeding season is June and August.
13. *Lefua echigonia* JORDAN et RICHARDSON.
14. *Cobitis biwae* JORDAN et SNYDER.
15. *Acheilognathus limbatum* (T. et SCH.)
16. *A. lanceolatum* (T. et SCH.).
17. *Hemibarbus barbus* (T. et SCH.).
18. *Leucogobio güntheri* ISHIKAWA.
19. *L. jordani* ISHIKAWA.
20. *Pseudogobio esocinus* (T. et SCH.).
21. *Sarcocheilichthys variegatus* (T. et SCH.).
22. *Pseudorasbora parva* (T. et SCH.).

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* Journ. Coll. Agric. Imp. Univ. Tôkyô = Journal of the College of Agriculture, Imperial University of Tôkyô published by the Agriculture Institute of Imperial University of Tôkyô.

** CHIYOMATSU ISHIKAWA and NISUKE TAKAHASHI: Journ. Coll. Agric. Imp. Univ. Tôkyô, 4(7).

23. *Richardsonius hakuensis* (GÜNTHER).
24. *R. jouyi* (JORDAN et SNYDER).
25. *Zacco platypus* (T. et SCH.).
26. *T. temmincki* (T. et SCH.).
27. *Cyprinus carpio* LINN. Breeding season occurs from May to June.
28. *Carassius auratus* (LINN.). Breeding season covers 5–6 months.
29. *Anguilla japonica* T. et SCH. Many different races are found in the specimens of Chiba Prefecture. "Gomaunagi", "Toraunagi", "Kiiunagi", "Hunagi", "Shirounagi", "Kurounagi", "Aounagi", "Shinaunagi". In the Tôkyô Fish Market, Mr. SABURO, FUJIMORI found "Saji", "Ao", "Gomaunagi" and "Geita"
30. *Gasterosteus cataphractus* (PALLAS).
31. *Mugil cephalus* LINN.
32. *Lateolabrax japonicus* (C. et V.).
33. *Cottus kazika* JORDAN et STARKS.
34. *C. pollux* GÜNTHER.
35. *Mogrunda obscura* (T. et SCH.).
36. *Rhinogobius similis* GILL.
37. *Acanthogobius flavimanus* (T. et SCH.). Breeding season is June.
38. *Tridentiger obscurus* (T. et SCH.).

1916

AMEMIYA, IKUSAKU, 1916: Structure of the Telescope Eye of Gold-fish. Suisan Gakkaihô, 1 (3), pp. 211–215. (in Japanese).

He studied the structure of the telescope eye of Japanese gold-fish and described the outer features, eye-muscles, eye-wall and retina. He made a comparison of the construction with those of normal lateral sided eyes and noted the optical considerations.

HIGURASHI, TADASHI, 1916: The Artificial Hatching and the Translocation of *Hypomesus olidus*. Suisan Ken-kyûshi, 11 (3), pp. 159–162. (in Japanese).

The artificial hatching was carried out in Kasumigaura in 1915. The translocation from Hinuma of Ibaraki Prefecture to Matsukawa Ura, Fukushima Prefecture was recorded in February of 1909. There are the first records related to the two phenomena. The experiments of translocation were carried out and succeeded in Lake Biwa and Lake Suwa. He has pointed out that the present species is rather important for economic fish though it is small in size. This plankton feeder is supplied as food for the carnivorous trout.

HONDA, KÔJI, 1916; Notes on *Ilisa elongata*. Rigakukai,* 13 (12), pp. 31–35. (in Japanese).

When the author retired from Kôshû in June of 1911, he brought two specimens and continued the study on this fish at the Fisheries Institution attached to the Agricultural Department of Tôkyô University. He also had a chance with the two good specimens, from Mr. KANEKO, MICHIHIRO of the Shimabara Middle School of Nagasaki Prefecture. The author recognized those specimens from China and Japan to be the same species except the Chinese character used in Lake Biwa. The species are distributed in Japan; to the south, in Seto Inland Sea and around Kyûshû.

KAWAMURA, TAMIJI, 1916: Story about "Higai". Zool. Mag., 28 (332), pp. 236–237. (in Japanese).

Sarcocheilichthys variegatus is a very common freshwater fish in the western part of Honshû and is famous because it was admired by Emperor Meiji. They are found in the market during all seasons and are caught in large numbers for food. The author thinks that the fish is not so excellent for food as the local people consider it to be. The fish is not peculiar to Lake Biwa and not the most important of all fishes of the lake. The dorsal aspect is darker than the ventral with black and yellow pigments. One colour variety is found in the lake. It shows entire black on dorsal and ventral sides with dense distribution of yellow pigments. They are called "Aburahigai" locally, and are quite distinct species. There are many variations of form, one is called "Kuchiboso" characterized by having lower head and long pointed snout, and the other one, called "Maruko", with round head and short snout.

* Rigakukai = Scientific Magazine published by Chukôkan. Tôkyô.

Some fish called "Sakurabae" in Mino Province appear in the market at the cherry blossom season. The allied species are found in Shanghai, South China which are darker than those of Lake Biwa. This fish is called "Oyaru" in Mimasaku Province but it is not yet clear about the original local name.

KAWAMURA, KYUJIRÔ, 1916: The Transplantation of *Hypomesus olidus*. Suisan Ken-kyûshi, 11 (4), pp. 190-202. (in Japanese).

The author describes a general idea of the transplantation of *Hypomesus olidus*. He discusses the following topics: the General Morphology, the Maturation, Fishing Preservation, Haching and Development, Transportation of Egg, and Transplantation. These items are quite related to the transplantation of *Hypomesus olidus* which have recently been transplanted to many Iakes and ponds for increasing the production.

MARUKAWA, HISATOSHI, 1916: Rate of Growth of *Anguilla japonica*. Zool. Mag., 28 (329), pp. 109 -110. (in Japanese).

The age of the Japanese eel may be determined by otoliths. and by the scales; however, age estimates made from the scales may be inaccurate. The development of scales is related to the rate of growth, and not to the age. The rate of growth is due to the nutritive conditions of the feeding grounds or to the temperature and to the sexual differences. In general, females grow more rapidly than males.

MARUKAWA, HISATOSHI, 1916: Studies on *Anguilla japonica*. Suisan Kôshûsho Shiken Hôkoku,** 11 (4). pp. 1-130. (in Japanese).

The author describes all about the Japanese Eel, containing the classification, distribution, the sexual difference and the relation of geographical variation and sex. He also mentions in this report on the body length and body weight, habits, reproduction, migration and movements, food and feeding season, the utilization of youngs on the immigration, biological production.

MATSUI, YOSHIICHI, 1916: Notes on the Races of Gold-fish and the Phylogeny. Nihongakujitsu Kyôkai Hôkoku* vol. 7, pp. 501-511, pls. 1-5. (in Japanese).

He has distinguished the races of gold-fishes by the characters of body form, scales, body colour, head, eye, dorsal fin, caudal fin, anal fin, pectoral fin and operculum. The seventeen races of gold-fish of Japan were described breifly and the phylogenetical trees were mentioned at the end of the paper.

MEEK, ALEXANDER, 1916: The Migrations of Fish. London Edward Arnold, pp. 1-427.

The author mentioned the migration of fishes in detail for each group. In his description of the distribution of *Carassius*, catfish and carps in the thirteenth chapter, he stated that the carps are distributed over the whole Northern Hemisphere, reaching south in America to Panama, and in the Old World to all the fresh waters of southern Asia, including India, Ceylon, the Malay Peninsula, Borneo and Sumatra, China and Japan, and also to South Africa. The carp is also found in the Amur and the rivers of China and Japan. It is believed to have been introduced into Europe and thence to England. The crucian carp, *Carassius carassius*, is widely distributed from Europe to eastern Asia, being found in the rivers to Europe, Black Sea, Caspian, and eastwards to China and Japan, extending north to the Amur, the Siberian rivers, including the Kolyma, and Lake Baikal. It was apparantly introduced to England from Hamburg, and it is this species which has been bread into the gold-fish in China and Japan. In regard to the Cobitidinae, he stated that the pond loach, *Misgurnus fossilis*, is found in central Europe, and from there to the Caspian, and also in the Amur, China and Japan.

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* Nihongakujitsu Kyôkai Hôkoku = Report of the Literature and Science Society of Japan published by the Nihongakujitsu Kyôkai, Tôkyô.

** Suisan Kôshûsho Shiken Hôkoku = Report of the Fisheries Experiment Station, Tôkyô, published by the Fisheries Experiment Station attached to the Fisheries Department of Ministry of Agriculture and Forestry. Tôkyô.

The loach, *Nemacheilus barbatulus*, is common in the British Isles, and along central Europe to the Caspin, and reaches Siberian rivers and Lake Baikal, the Amur, and Japan. The spinous loach, *Cobits taenia*, is confined to the south of England, and extends across Europe and Asia to Siberia, Baikal, the Amur, China and Japan. In the fifteenth chapter he mentioned that *Gastrosteus aculeatus* is distributed in Europe, from the Arctic Ocean including Greenland and Iceland to the Black Sea. It is also found in the streams and rivers of Algiers and in Asia, from Northern Siberia where it is common, to Transcaubasia on the one hand, the Amur, Behring Island and Japan on the other. The Pacific three-spined stickleback, called by American writers *G. cataphractus* (PALLAS) is distributed from Alaska to California and to Japan. *Pygosteus sinensis* is found in the Amur, China and Japan and *P. tymensis* of Eastern Siberia and Japan is also mentioned by him.

WATANABE, MUNESHIGE, 1916: The Influence of Symptom on the Movement of Melanophore of the Scale of *Sarcocheilichthys variegatus* T. et S. Kyôto Igaku Zasshi,* vol. 13, pp. 207–211. (in Japanese).

The chromatophore of this fish is consisting of two kinds of melanophore and xanthophore. The other group is iridosystem which is composed of guanin. The writer makes many experiments upon the various chromatophores and iridocyte under the many different solutions and knows how they move.

1917

AMEMIYA, IKUSAKU, 1917: Fishes from the Lakes located North of the Foot of Mount Fuji. Suisan Gakkaihô, 2 (2), pp. 71–73. (in Japanese).

The author described the fishes of Lakes Kawaguchi, Yamanaka, Sai and Shojin located north of the foot fo Mount Fuji. There are found many introduced fishes; *Cyprinus carpio* of Lake Yamanaka was transplanted from the Tone River, Ibaraki Prefecture; *Zacco temmincki* of Lake Kawaguchi from Lake Suwa, Nagano Prefecture, and *Parasilurus asotus* of Lake Sai from Lake Kawaguchi during 1879–1880. *Oncorhynchus nerka* of Lake Sai was introduced from Lake Towada in 1912. He described a list of fishes of these lakes as follows: *Parasilurus asotus, Misgurnus anguillicaudatus, Cobitis biwae, Leucogobio güntherii, Leuciscus hakuensis, Leuciscus jouyi, Leuciscus phalacrocorax, Zacco platyprus, Cyprinus carpio, Carassiuus auratus, Oncorhynchus masou, O. nerka, Salvelinus pluvius*, and *Anguilla japonica.*

AMEMIYA, IKUSAKU, 1917: Über das Teleskopauge des Goldfisches. Journ. Coll. Agr. Imp. Univ. Tôkyô, vol. 6, no. 3, pp. 245–259.

The present paper was written in German and has the same conclusion as the previous paper* published in 1916 in Japanese.

KUMAGAE, SABURO and **TANAKA SHIGEO,** 1917: Fishes of Izunuma, Miyagi Prefecture. Zool. Mag., 29 (346), pp. 249–251. (in Japanese).

Izunuma (a large swamp, about 210 m round) is located near Niita Station of the Tôhoku Main Line in Honshû. The author listed the following 24 species.

1. *Lampetra planeri.*
2. *Oncorhynchus masou* (BREVOORT). Ascending the river in August
3. *Plecoglossus altivelis* T. et SCH. Ascending the River Ara in August.
4. *Hypomesus olidus* (PALLAS). Breeding in the sea, from March to April.
5. *Parasilurus asotus* (LINN.).
6, *Pseudobagrus aurantiacus* (T. et SCH.).
7. *Cobitis biwae* J. et SNY.
8. *Misgurnus anguillicaudatus* (CANTOR).
9. *Lefua echigonia* J. et RICH.
10. *Pseudoperilampus typus* BLEEKER.
11. *Acheilognathus* sp. J. et THOM.
12. *Ach. intermedius* T. et SCH.
13. *Pseudorasbora parva* (T. et SCH.).
14. *Pseudogobio esocinus* (T. et SCH.).
15. *Richardsonius phalacrocorax* (J. et F.).

* Kyôto Igaku Zasshi = Medical Magazine published by the Medical Society of Kyôto.

16. *Cyprins carpio* LINN.
17. *Carassius auratus* (LINN.).
18. *Anguilla japonica* T. et SCH.
19. *Oryzias latipes* (T. et SCH.).
20. *Hyporhamphus sajori* (T. et SCH.). At the beginning of June, this ascends the river Arakawa into this swamp and descends the river in the first part of November. Some of them stay in the swamp.
21. *Mugil cephalus* (F.).
22. *Rhinogobius kurodai* TANAKA.
23. *Chloea senbae* TANAKA. The breeding season is in April, with reddish belly.
24. *Tridentiger obscurus* (T. et SCH.).

1918

ÔTA, YASUHARU, 1918: *Salvelinus* of Japan. Suisan Gakkaihô, 2 (3), pp. 227–232, pl. 1. (in Japanese).

The author mentions the four species belonging to the Genus *Salvelinus* found in Japan.

1. *Salvelinus malma* (WALBAUM) ("Oshorokoma" in Japanese).

This species is distributed in Hokkaidô, Karafuto, the Kurile Islands and Kamtchatka Peninsula. It may spawn in September. The author found many small ones measured 6–12 cm. in a stream, somewhat upper from the mouth of a river, along the western coast of Kamtchatka in July. He observed many eggs of *Oncorhynchus gorbusha* (WALBAUM) in the stomach.

2. *Salvelinus kundcha* (PALLAS) ("Kunja" in Japanese).

This species is abundant in Saghalien, Kamtchatka Peninsula, the Kuriles and probabiy his observations were done in Karafuto and Hokkaidô.

3. *Salvelinus pluvius* (HILGENDORF) ("Iwana" in Japanese).

This species is quite common, distributed from Aomori Prefecture in the north down to Lake Biwa in the south of Honshû. It likes clear current waters and lives in upper rivers of the middle of Honshû, not descending into sea.

4. *Salvelinus latus* sp. nov.

This species is different from *Salvelinus malma* (WALBAUM) in the less number of vertebrae. This is also different from *Salvelinus kundscha* (PALLAS) in the presence of cloudy patterns on the back and of the smaller white spots. Furthermore, it differs from *Sal. kundcha* (PALLAS) in having a supraoccipital with no elevated part. This is also different from *Sal. pluvius* in the heigher body and in having no tooth on the basiopercle. The type specimen is obtained by Mr. NONAKA, KOHIRA, at Nô, Niigata Prefecture. Two specimens are measured about 18 cm. and 15 cm. and both of them have 14 parr marks. From these characters, the author elected it into a new species named *Salvelinus latus* n. sp.

TAKESHITA, MASANOSUKE, 1918: New Examples of the Fish Pronephros (I). Zool. Mag.,30 (351), pp. 20–23. (in Japanese).

The author finds out a pronephros in *Salangichthys microdon*, which was collected at Tôkyô Fish Market.

TAKESHITA, MASANOSUKE, 1918: New Examples of the Fish Pronephros (II). Zool. Mag., 30(352). pp. 34–37. (in Japanese).

In the second report, he also mentions a pronephros in *Aplocheilus latipes* as suggested by Prof. GOTO SEITARO. He also added 33 spp. which have pronephros in the adults.

TANAKA, AKAMARO, 1918: Studies on Lake Suwa. vols. 1–2, pp. 1–1682, Tôkyô, Iwanami Shoten. (in Japanese).

This book is consisting of two volumes; the 1st volume shows general aspects of Lake Suwa, including hydrographical studies and the second volume indicates hydrobiological studies and fisheries as well as arts and literatures. In the chapter of aquatic animals, the author shows a list of freshwater fishes of Lake Suwa.

I. Siluridae
1. *Liobagrus reini* HILGENDORF "Akaza".
2. *Parasilurus asotus* (LINNAEUS) "Namazu".
II. Cobitidae
3. *Misgurnus anguillicaudatus* (CANTOR) "Dojo".
III. Cyprinidae
4. *Cyprinus carpio* LINNAEUS "Koi".
5. *Carassius auratus* (LINN.) "Funa".
6. *Sarcocheilichthys variegatus* (T. et S.) "Higai".
7. *Gnathopogon elongatus* (T. et S.) "Honmoroko".
8. *Pseudgobio esocinus* (T. et S.) "Kamatsuka".
9. *Zacco platypus* (T. et S.) "Oikawa".
10. *Leuciscus hakuensis* GÜNTHER "Akahara".
IV. Anguillidae
11. *Anguilla japonica* T. et S. "Unagi".
V. Salmonidae
12. *Oncorhynchus masou* BREVOORT. "Masu".
13. *Plecoglossus altivelis* T. et S. "Ayu".
14. *Hypomesus olidus* (PALLAS) "Wakasagi".
VI. Gobiidae
15. *Rhinogobius similis* GILL.
16. *Fluvidraco nudiceps* (SAUVAGE).
17. *Pseudospinus atrilatus* JORDAN et THOMPSON.
18. *Oryzias latipes* (T. et S.).

1919

MATSUI, YOSHIICHI, 1919: Reviewed on the Transparent Scale of *Carassius auratus*. Suisan Kenkyûshi, 4 (4), p. 98. (in Japanese).

The author reported a variety of *Carassius auratus* with transparent scale, called "*Gyokibuna*" several years ago. He has obtained one more specimens from a culture pond located around Hikone castle, near Biwa Lake by the courtesy of Mr. J. KAWABATA, the director of the experimental fisheries station of Shiga Prefecture. This specimen has the tranparent scales on the trunk and opercle without guanin chromatophores. The former example belongs to "*Marubuna*" type while the present specimen may be a type between "*Gengorobuna*" and "*Hirabuna*", measured 7.4 cm. According to Mr. K. UCHIYAMA, this crusian carp is called "*Kattaibuna*" and rater rarely found in Lake Biwa.

1921

AMEMIYA, IKUSAKU, 1921: Note on the Eggs of the Ovary of the Down Eel. Suisan Gakkaihô, 3 (3), p. 235. (in Japanese).

The author observed the ovary of an eel (36.3 gm. in weight), collected at Ito River, Izu, Shizuoka Prefecture on January 29, 1917. The ovary is intranslucent and in the condition of so-called KRAUSEN organ. The ovicell has uniform yolk granules and a vacuolated space round the nucleus which is large and multinucleolus. The follicle cells are entirely degenerated. The ovicell measured 0.15-0.2 mm., somewhat larger than that described by WALTER's measuring 0.3-0.08 mm.

AMEMIYA, IKUSAKU, 1921: The Correlation between the Egg Development of Land-locked *Hypomesus olidus* and *Salangichthys microdon*, and different Salinities. Suisan Gakkaihô, 3 (3), pp. 182-185. (in Japanese).

The author intended to confirm the correlations between the egg development of a land-locked *Hypomesus olidus* and *Salangichthys microdon*, and different salinities. He used the eggs of *Hypomesus olidus*, fertilized artificially at Shitozaki, Kasumigaura, Ibaraki Prefecture, on 25th, January of 1921. He observed the development of 50 eggs in each different degree of salinity. The results are as follows. As the present fish from Kasumigaura are quite land-locked and adapted for freshwater life, the salinity of sea-water had a somewhat toxic influence on them. In a salinity of more than 19%, all the eggs died and in 10%-17% part of the eggs died. The higher degree of salinity is more harmful than the lower degree for the egg development. The hatched out larva are quite unharmed in less than 24% salinity. In the experiments of *Salangichthys microdon* for different degrees of salinity, by using the artificial fertilized eggs from Shitozaki, Kasumigaura, Ibaraki Prefecture, it was found that the salinity has no definite influence on the egg development.

AMEMIYA, IKUSAKU, 1921: Young *Oncorhynchus keta* obtained at Ushibori, Ibaraki Prefecture. Sui-

san Gakkaihô 3, (4), p. 301. (in Japanese).

On the 22nd of April, 1922, he received two young fish specimens from a student, Mr. KATO, who caught them at Ushibori, Ibaraki Prefecture. After his observations, he identified them as *Oncorhynchus keta*. One specimen measured 8.4 cm. and the other 9.3 cm. in body length. Stomach contents consisted of freshwater shrimps and insect larva. From these facts, the author confirmed that some Japanese salmon live in the brackish water territory a considerable time after hatching out and then go down river into the sea.

HORIKAWA, YASUICHI, 1921: Observation on *Gasterosteus cataphractus*. Zool. Mag., 24 (285), pp. 418-420. (in Japanese).

The author made his observations at Hiroe River, Kano Machi, Gifu, on February 10th, 1909. From the observation of 32 females the number of eggs in a female is very variable, ranging from 30 to 368, the spawning may occurr twice in a breeding season. The number of eggs in a nest is also variable, numbering from 28 to 1509. The action of spawning continued only one or two days.

ISHIKAWA, CHIYOMATSU, 1921: Some Experiment for the Explantation of the Eggs of *Plecoglossus* from Japan to United States of America. Zool. Mag., 33 (390), pp. 121-122. (in Japanese).

Prof. D. S. JORDAN once wished to transport the eggs of *Plecoglossus altivelis*. When he was Japan in 1920, he showed the author a disposition to send them from Japan to his country. Then I asked Mr. TADASHI, HIGURASHI of the Fisheries Institution in Tôkyô who answered that they had already sent them thrice to the United States unsuccessfully, but that he would try again in the name of Dr. ISHIKAWA. For the first time, he sent some in the ship Persia, which sailed out on September. 25th, 1921. In these experiments, all of the fishes were found dead. The experiment was tried once again on October 22nd of 1921, when 10-15% of the eggs were found not alive. The hatching out embryos were still alive but soon died after hatching out.

NAKAI, NOBUTAKA, 1921: Natural Foods of Trout. (1), Suisan Ken-kyûshi, 16 (1), pp. 19-22. (in Japanese).

When the author collected many materials in the fish culture pond at Marunuma of Gumma Prefecture in 1913 to 1915, he tried to examine the natural food of trout. He divides the food into the pelagic, the littoral and the insects and small animals which fall down from the air.

I. Pelagic animals.
  Phyllopoda …… *Daphne longispina* MÜLLER.
  Diaptomus denticornis.

II. Littoral animals.
  a. Aquatic insects …… *Gyrinus* sp.
  b. Annelids and crustaceans …… *Tubifex* sp., *Asellus* sp.
  c. Larva of Insects …… Pupa and larva of *Chironomus* sp.
    (Diptera) Larva of *Simulium* sp., Larva of *Dicranota* sp.
    (Trichoptera) …… Larva of *Phrygania*, Larva of *Stenopsyche*, *Criscipennis* Larva, of *Limnophilus*, Larva of *Trichoptera* sp.
    (Neuroptera) …… Larva of *Sialis*.
    (Plecoptera) …… Larva of *Perlodes* sp.

III. Insects and small animals which fall down from the air.
  a. Insects related to the larva of aquatic life.
    (Thysanoura) *Achorutes communis* FOLS.
    (Ephaemerida) *Siphlurus sapporensis* MATS.
    (Plectoptera) *Perla* sp., *Neuronia* sp.

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* Structure of the telescope eye of Gold-fish, 1916, Suisan Gakkaihô, 1 (3), pp. 211-215. (in Japanese).

(Trichoptera)	*Stenopsyche griscipennis* ML.

b. Insects not related to the larva of aquatic life.

(Rhynchota)	*Aphis* sp., *Tettigonia viridis* L., *Tricentrus flavipes* UHL., *Aphrophora vittata* MATS., *Capsus alter* JAK. *Tropicoris rufipes* L.
(Mecoptera)	*Panopa pryeri* M'L
(Lepidoptera)	*Arctia caja* L., *Chils* sp.
(Diptera)	*Eristalis incisuralis*
(Coleoptera)	*Coccinella* sp., *Leptura* sp., *Xanthophora waterhausei*, *Pyrochroa* sp., *Telephorus viridipennis* KIES., *Elater* sp., *Hoplia obducata* MATS., *Serica boops*
(Orthoptera)	*Tetlix japonicus* D. H.
(Neuroptera)	*Chrysopa* sp., *Osmylus tesselatus*, *Osmylus* sp., *Acanthoclisis japonicus* HAG.
(Diptera)	*Tipula* sp.
	WATERH.
(Himenoptera)	*Ichneumon albizonellus* MATS., *Astiphromma* sp., *Mesochorus* sp., *Panisous* sp., *Camponotus herculeanus*, *Lasius alienus*, *Lasius umbratus*.

IV. Aquatic animals ...... *Palaemon* sp.
Eggs and young fishes of *Oncorhynchus masou* BREV.
Youngs of *Plecoglossus altivelis* T. & SCH.

NAKAI, NOBUKATSU, 1921: Natural Foods of Trout (2), Suisan Ken-kyûshi, 16 (2), pp. 44-50. (in Japanese).

This is the second paper that continues the 1st and treats the changes of natural food in different seasons.

1. The difference of food of trout by the season.

Among the 417 individuals examined by the author; he formed 30 individuals which take planktons; 107 individuals taking 196 littoral Insects, Annelids and Crustaceans; and the animals which fall down from the air, 172 individuals: aquatic large animals, 17 individuals and the trout youngs and eggs are 16 individuals.

The percentage of each food taken by the trout in one year is as follows.

1. Plankton 7%
2. Littoral animals 47%
   a). Aquatic insects......9%
   b). Annelids and Crustaceans 12%
   c). Insect larva 26%
3. Insects down from the air 41%
   a). Insects whose larvae are concerned to water life 12%
   b). Insects whose larvae are not concerned to water life 29%
4. Aquatic large animals 5%

From these observations, most of the trout food is consisting of insects and their larvae, large crustaceans and aquatic animals.

NOMURA, KANICHI, 1921: Two aged *Plecoglossus altivelis*. Suisan Gakkaihô, 3 (3), pp. 205-209. (in Japanese).

The author makes an observation on one-aged and two-aged *Plecoglossus altivelis* from morphologcal aspects. He makes a difference as shown by the following table.

characters	*one-aged*	*two-aged*
Dorsal color	black greenish	light brownish black green
Lateral color	light blue with orange	light blue with brown
Form	——	slender
Pectoral pattern	light cream-yellow, outline undistinct	outline distinct
Adipose fin	upper margin orange and distinct	undistinct
Size of eye	——	somewhat larger

Dorsal margin of head	somewhat strongly curved	somewhat rounded
Skin	smooth	somewhat rough
Hardness of bone	somewhat soft	somewhat hard
Scale	complete circuli continued to the margin	not continued, somewhat broken
Sex	——	most of them is female

It is very interesting facts that the most of the 2nd aged adult are female. The author supposed that this fact might come from the death of the male from the starvation after spawning.

OKAMOTO, KIKUO, 1921: A Second Sexual Characters of *Misgurnus anguillicaudatus*. Zool. Mag., 33 (392), pp. 19–20. (in Japanese).

The author distinguishes the females and males of this loach by the outer configurations.

1. In the male, an elliptical bump on each side of the trunk is just on the dorsal of nephridiopore. The epidermis is somewhat thick and has many "Kolbzelle" inside.
2. Pouch for scale extends and has many feltcells inside in somewhat colloidal conditions.
3. Felt tissues are distributed between the epidermis and muscle layer, and has many melanophores.
4. A bump of the male appears in a larger one measured 7 cm or more.
5. A pectoral fin of the male is larger and about twice of the female.
6. The pectoral fin is easily distinguished from other fins by its somewhat pointed end.

1922

AMEMIYA, IKUSAKU, 1922: A Young Salmon caught at Ushibori, the Tone River, Ibaraki Prefecture. Suisan Gakkaihô, 3 (4), p. 301. (in Japanese).

The author found out two youngs of salmon in the fish catching at Ushibori, Ibaraki Prefecture. They have the characters as follows. Gill rakers, 9+15=24, Branchiostegal rays 14, Anal rays 15 or 16. He caught the youngs, measured 8.4 and 9.3 cm. in body length, on the 22nd of April in 1922. The stomach contents is shrimps and larvae of insects. From this fact, he supposes, the young salmon stays a while in freshwater after hatching out to take foods, and then descends into the sea.

AMEMIYA, IKUSAKU, 1922: An Example of Rapid Growth in Eels. Suisan Gakkaihô, 3 (4), p. 302. (in Japanese).

The fishermen transplanted many elvers (2-6 grm. in weight) into Lake Yamanaka at the foot of Mt. Fuji, Yamanashi Prefecture, in November of 1920. After one year (1922), they caught adult eels weighing about 50-90 gm. Such an example indicates a rapid growth of eels in one full year and plentiful amounts of natural eel food in Lake Yamanaka.

AMEMIYA, IKUSAKU, 1922: The Relation between the Development of Eggs of *Plecoglossus altivelis* and Salinity. Suisan Gakkaihô, 3 (4), pp, 299-301. (in Japanese).

From the fact that *Plecoglossus altivelis* spawn in the brackish water of the estuary of Gokase River, Miyazaki Prefecture, Kyûshû, the author intended to make experiments on the relation between the egg development and salinity. The method was to prepare artificially fertilized eggs, keeping them 20 hours after fertilization to use the complete egg development for the experiment. He made also three sets of solutions of different salinities, 22–39%, 22%, 10%. From the results of his experiments with the solution of 22–28% salinity, all the embryos died, in 22% some died, and in 10% all lived. The eggs kept in salt water solution hatch out somewhat later than in freshwater.

ANNANDALE, N., 1922: The Macroscopic Fauna of Lake Biwa. Annot. Zool. Jap., 10 (5), pp. 127–153.

When the author was in Japan in 1915, he made a biological survey of the freshwater fauna of Lake Biwa and mentioned the detailed descriptions of many freshwater animal groups. In the chapter on Pisces (pp. 138–139), he made the following notes: "The following families are represented in the fish fauna of Lake Biwa. - - Salmonidae, with 3 species; Siluridae, with 5 species; Cyprinodontidae, with a species; Cobitidae, with at least 6 species; Cyprinidae, with at least 30 species; Gobiidae, with 7 species; Anguillidae and Cottidae with 1 species each: Poecilidae with 1 species, and Cataphracti, with 1 species. Apart from the fishes, a single species of Lamprey (*Lampetra planeri* BLOCH) occurs. The Cyprinidae are thus the dominant family, as is the case in most freshwater faunas. The genera represented are characteristic of the Chinese Province. Among the other fishes one of the most interesting is the Cyprinodont *Haplochilus melastigma* MCCLELLAND. This species was placed by TANAKA in the Poecilidae under the name *Oryzias latipes* (SCHLEGEL) and was listed in Japan, TANAKA and SNYDER's catalogue of Japanese fishes, as *Oryzias latipes* (T. et SCH.), but Dr. B. L. CHAUDHURI, after a careful comparison of specimens from China and Japan with typical individuals from India, was unable to find any specifference. As the species is unknown from any locality intermediate between the Malay Peninsula and Shanghai the distribution appears to be extremely discontinuous, but so small a fish is very liable to escape notice. The Salmonid *Plecoglossus altivelis* T. et SCH. is, according to the pamphlet of the fishery authorities, found in the lake in 3 distinct phases, each of which has a different habitat and different habits. We many conveniently refer to these 3 phases by their Japanese names, viz., "Ayu", "O-Ayu", and "Ko-Ayu". The Ayu, which is the largest, breeds in the sea and is anadromous; it reaches a maximum length of about a foot. The "O-Ayu" is supposed to have come from the sea and to have comparatively recently adopted the habit of going up the rivers that run into Lake Biwa to breed. It is much smaller than the Ayu and has a light yellow back. It returns to the lake after breeding. The "Ko-Ayu. which is much the smallest race, is non-migratory and strictly lacustrine in habits. In addition to the fish indigenous in the lake, the following species have been introduced artificially; - - *Oncorhynchus keta* from Hokkaidô, *O. nerka* also from Hokkaidô, *Salmo irideus* from California, *Salvelinus pluvius* from Lake Chûzenji in Japan, *S. fontinalis* from America, *Osmerus olidus* from other parts of Japan, and the "leather" and "mirror" carp (forms of *Cyprinus carpio*) from Germany". He also made notes on the geographical and ecological distribution of the fauna in the lake and the animal associations in the non-abyssal benthic, the abyssal benthic and pelagic associations in the lake. At the end of his paper, he concluded with a comparison betweeen the fauna of Lake Biwa and that of certain other lakes found on the Asiatic continent.

1923

FUKUDA, RYOZÔ, 1923: The Histological Studies of the Intestine of *Misgurnus anguillicaudatus*. (2). Suisan Ken-kyûshi, 18 (1), pp. 9–14. (in Japanese).

This is the second report of the histological studies of Loach. The author made the conclusion as follows.

1. The surface area of mucous membrane is very broad on the anterior intestine and narrower on the middle and very narrow on the posterior intestine.
2. The surface area of the lower layer of mucous membrane is the broadest on the anterior intestine and less broad on the middle and very narrow on the last.
3. The distribution of vessels is very abundant on the posterior intestine and the middle and anterior intestine, follows in order.
4. The surface area of the longitudinal muscle and circular muscle is very broad on the anterior intestine and narrow on the middle and posterior intestine.
5. In general, the amount of oil contents in the mucous membrane is very abundant in the posterior intestine and then middle and anterior intestine.
6. The mitochondria is abundant in every part of villi and rather numerous in anterior intestine.
7. The amount of mitochondria found in villi is numerous in the anterior intestine.
8. The existence of mitochondria has a relation directly to nutrition but not to respiration.
9. From his experiment, he concludes that the mitochondria does not relate to respiration. In the

posterior intestine, the vessels are abundantly distributed and the preservation of oil substance is distinct. In there the loaches respirates well.

OYAMA, JUNJI, 1923: On the Lampreys of Japan. Zool. Mag., 35 (412), pp. 77-84. (in Japanese).

The author made the anatomical studies on the Japanese *Lampreys* and summarized as follows. According to the latest view of Dr. HATTA at Sapporo, who is the foremost worker in Japan on the study of the lampreys, the Japanese lampreys belong to the following two species, namely *Lampetra fluviatilis* (L.) and *L. planeri* (BLOCH). For the former species I have no doubt as to its validity, but for the latter I can not agree with him wholly. In his earlier papers, HATTA called the latter *L. mitsikurii* and divided it into two subspecies, *major* and *minor*. And these two subspecies have recently been withdrawn by him because he could not draw a line of distinction between them, and were put together under the name *L. planeri*. But I should like to receive a part of his former view that two are fixed and distinct species, on the ground that they are found in the same place in Hokkaidô and that the considerable difference is actually seen in dimensions. Another point as stated in my previous paper (Zool. Mag., vols. 31-32) that I had found a difference between *major* and *minor* in the form of a certain myotome, I withdraw now. I have found that the material I examined then were not satisfactory; they were apparently adult but in reality they were individuals which had not completed the metamorphosis yet. But still as above, I hold the view that the two must be divided. If my proposal be accepted, the name for the larger brook lamprey will be simply *L. mitsukurii* HATTA, and then Japan will have the following three species of lampreyst:

Lampreys fluviatilis (LINN.), *L. mitsukurii* HATTA, *L. planeri* (BLOCH).

TOZAWA, TOMIZYU, 1923: Studies on the Pearl Organ of the Gold fish. Ann. Zool. Jap., 10 (25), pp. 253-265.

The author makes experimental studies on the pearl organ of the goldfish during 1920-22. The pearl organs are found on the operculum and along the rays of the pectoral, dorsal and anal fins of the male fish. There are in a year from 3 to 6 periods of maximal growth of the pearl organs. Between any two periods there is sometimes an interval of 3-10 days, during which time no pearl organs are present. If the fish is castrated before the cornification sets in, the pearl organs fail to appear at least as late as the end of May. If the fish is castrated during the periods of absence of the pearl organs, the formation of the organ is retarded and the following intervals of total lack of the pearl organs become longer (17-20 days). If the fish is castrated during a period of the highest development of the pearl organs, they fall off earlier than in the normal fish. In the conclusion he mentions that the formation of the pearl organ, that is, the cornification of the epidermis, is influenced by the substance or substances produced from the tests.

1924

HIRAIWA, YOSHIKUNI, 1924: Literature of Goldfish and Crucian Carp. Zool. Mag., 36 (432), pp. 443-447. (in Japanese).

The author listed up the literatures concerned with goldfish and crucian carp used for the materials of Experimental Zoology from the bibliography of fishes by Dr. BASHFORD DEAN.

KISHIDA, KYÛKICHI, 1924: Catalogue of freshwater Fishes from the Yura River, Tango Province. Zool. Mag., 36 (423), pp. 61-62. (in Japanese).

The author collected the specimens from the Yura River during April, and March of 1924.

In this paper 35 species are listed. Besides these there seems to be found *Bryttosus kawamebari* and *Pygosteus sinensis*, but actually they were not found. A fish called "Guzu" found at Kazue-mura, Yatsue-mura, Kasa-gun is not yet identified by specialists.

TOZAWA, TOMIZYU, 1924: The Relation between the Pearl Organs of Goldfish and Gonad. Zool.

Mag., 36 (424), pp. 77–88. (in Japanese).

The author already reported this study in Ann. Zool. Jap., Vol. 10, No. 6 (1923). Here he repeats his results in more details, in Japanese.

TOZAWA, TOMIZYU, 1924: Some Experiments of Color Changes of Goldfish. Zool. Mag., 36 (431), pp. 373–376. (in Japanese).

The author makes many experiments on color changeable experiments by using goldfish during June 1st to July 24th in 1920.

He noticed three kinds of chromatophores; Xanthophore, Melanophore and Guanin crystal in the body of the fish. In the young, the melanophore is larger than Xanthophore and more numerous. Generally the color of the fish becomes blacker to the movements of melanophore. The one example that in the case of black aquarium inside where the young fish is keeping, the melanin granules are eaten by phagocytes and immigrate to the surface of body and leave the body while the phagocytes in the body are send from the intestinal canal and the remainings disappear through the changes of nature and then the Xanthophore appears to be red. In the other experiment in a white aquarium, the young fish very light in color by the gathering of Melanin and Lipochrome granules in the cells and then by the breaking of chromatophores and active movement of phagocytes the many chromatophores are sent out of the body to be white.

1925

GIFU HOSYÔKAI, 1925: The Cormorant Fishing on the River Nagara, Gifu, Japan. pp. 1–18. (in Japanese).

This is a small pamphlet to exhibit a peculiar Japanese fishing of "Ayu" and other fishes with cormorants in ths River Nagara of Gifu Prefecture. The origin of fishing with cormorant in Japan is not known exactly, yet that of the fishing on the River Nagara can be traced up as far as over one thousand years ago. This is the way of catching and training of the natural cormorants. To catch cormorants, bird-lime is put upon some rocks which stand in the sea, and when one of them is caught, it is kept, as a decoy, upon an available rock, and around the rock some bird-lime is put, as a means for catching other cormorants that come near their old friend taking no notice of the dangerous contrivance which dooms their fate. The cormorants caught in this way are set free once every day on a river for training by swimming and standing on the edge of a boat, but as they can not catch fish and are often apt to bite people until they are completely tamed, their beaks are found with straw-rope. When fishing is finished, all the cormorants stand in order on the edge of a boat in the altitude of triumphant warriors and if there happens any mistake in their precedence, they suddenly start a quarrel and keep it on until they are put in proper position. This fishing can be carried on every evening from May 11th until October 15th, except on the moon-light night or in muddy water. Each or the fishing-boats which are usually 12 in number, carries a crew consisting of a chief fisherman, an assistant, and boatsmen. As soon as the chief sees fish gathering round the torch, he lets loose the string and the cormorants quickly swim after the fish and dive into the water to catch them. It needs skill for managing so many strings at a time, as they are apt to be entangled by the struggles of the birds. When a cormorant has swallowed a certain number of fish, the fisherman hauls in the bird and makes it disgorge them by pressing on its neck and throat. Immediately the fisherman again lets the bird go after the fish. When a fish is caught, whether by the head or tail, the cormorant would swallow it by the head first.

HIGURASHI, TADASHI, 1925: A Culture of *Misgurnus anguillicaudatus.* Suisan Ken-kyûshi, 20 (2), pp. 49–53. (in Japanese).

This loach culture is carried out in Tôkyô-to and in the Fisheries Institution of Shiga. From the experiments, the author concludes that the water temperature of pond should be 20–25°C in optimum to rear them. The female larger than the male which has two lateral elevations on both sides of the

trunk. The breeding period begins in May and end in September, eggs being deposited several times and not all in one time. The growth of youngs in a pond is as shown in the following.

4th day after hatching out	body length
5, VIII	6.0 mm
8, VIII	11.0 mm
12, VIII	13.0 mm
18, VIII	17.0 mm
30, VIII	34.0 mm

They feed the loach with *Daphnia*, *Limnodrilus*, freshwater mussels, and dried pupae and wheatpowder.

HIGURASHI, TADASHI, 1925: Optimum Water Temperature for Hatching the Eggs of *Hypomesus olidus* PALLAS. Jour. Imp. Fish. Inst.,* 20 (4), pp. 4–5. (in Japanese).

From the results of experiments he recognized the normal development of the eggs could take place in the range of temperature 7°–15°C. for all the hatched fries with about 6 mm. body length were in very active condition. The number of days from the fertilization for hatching may vary with the water temperatures as follows; when 7°C. in temperature may take 38 days; 8°C.. 33 days; 9°C., 28 days; 10°C., 24 days; 11°C., 21 days; 13°C., 16 days; 16°C., 11 days.

HIGURASHI, TADASHI, 1925: Optimum Water Temperature for Hatching of the Eggs of *Plecoglossus altivelis* T. et S. Jour. Imp. Fish. Inst., 20 (4), pp. 1–3. (in Japanese with English summary).

He has attempted to determine the maximum and minimum water temperatures for the normal development of the eggs of *Plecoglossus altivelis* T. et S. The materials were obtained from the Tama River on 26, October, 1925. The results of the experiment are as follows; The eggs developed normally within the limit of temperature 10°C. and 19°C. and the optimum water temperature for hatching the eggs was about 15°C. The number of days required for hatching out after fertilization was variable according to the temperature. When the water temperature was 10°C. number of days after fertilization was 30 days and at 15°C., 20 days and at 18°C., 15 days.

HUBBS, C. L., 1925: A Revision of the Osmerid Fishes of the North Pacific. Proc. Biol. Soc., 38, pp. 49–56. Washington.

The author made the revision of the Osmerid fishes of the North Pacific. He has included three species of Osmerid fishes found in Japan as follows.

1. *Hypomesus olidus* PALLAS.

He has distinguished two species of *Hypomesus*, one is *Hy. olidus* PALLAS and the other is *Hy. japonicus* BREVOORT. The former ranges from the moutain lakes of central Japan to the shores and coastwise freshwaters of northern Japan. The latter is distributed in northern Japan and has been confused with *Hy. olidus* systematically.

2. *Spirinchus lanceolatus* (HIKITA).

The present species is based on a tuberculate male, collected in Iburi, Hokkaidô, presented to Dr. JORDAN by Dr. T. KAWAMURA.

MATSUI, YOSHIICHI, 1925: On the Warty Growths of Japanese Lionhead Goldfish. Ann. Zool. Jap. 10 (35) pp. 355–362.

The warty excrescence appears on the head of Lionhead, a kind of goldfish. The author remarks on this excrescence and studies histologically and discusses the relation with the skull. This is found in the cranial infraorbital and opercular regions of Lionhead. The degree of development of the head growths depends upon external conditions. Clear water and plenty of animal food accelerate it, while

* Jour. Imp. Fish Inst. = Journal of the Imperial Fisheries Institution published by the Fisheries Institution attached to the Ministry of Agriculture and Forestry Tôkyô.

water with much algal growth and much vegetative food retards or even arrests it. As early as 40 days after the hatching, the epidermis of the head undergoes unequal growth. Soon foldings ensue. The papillae and terminal buds disappear and faulse papillae are formed as the result of the folding. The epidermis thickens two to three times as thick. Due to the osseous growth into the epidermal foldings the ridges and cribration on the skull become more prominent.

ŌTA, CHINORI, 1925: The Propagation of Iwana (*Salvelinus pluvius*). Suisan Ken-kyûshi, 20 (9), pp. 15–22. (in Japanese).

These experiments were carried out in the Kizaki Fish Culture Station attached to the Fisheries Institution of the Agricultural Department. The experimental grounds were oriented at the River Miyagawa, Kamikôchi, about 3179 meters in elevation. The water temperature there is not so high, and very rarely rises beyond 24°C. The spawning areas are found in the four places, the River Minogawa; the River Shimizu; Tashiro pond; Myôzin Lake. The breeding season occurs from the beginning of October to the middle of February. The number of eggs in an adult is calculated as follows.

Body length	*Body weight*	*Number of eggs*	*Body length*	*Body weight*	*Number of eggs*
4. 9 cm	143 cm	432	24. 0 cm	133 cm	254
4. 6	123	448	21. 8	98	233
4. 10	77	241	19. 5	76	210
24. 0	142	321			

In general, a three year fish deposits 350–450 eggs.

TAKAHASHI, NISUKE, 1925: On the Homology of the Crainal Muscles of the Cypriniform Fishes. Jour. Morph. & Physiol., 40 (1), pp. 1–103.

The writer abstracts his study on the Homology of the Cranial Muscles of the Cypriniform Fishes in this report. As a step toward the solution of this problem, the present study gives a detailed description of the twenty cranial muscles in a number of species belonging to three groups of cypriniform fishes: Cyprinoids, Cobitoids, and Siluroids. Particular attention is given to the morphological relations of the following muscles: adductor mandibulae, geniohyoideus, levator arcus branchialis, adductor arcus palatini, retractor branchialis dorsalis, interarcualis dorsalis and the trapezius. Comparison is made between corresponding muscles in different members of the three groups of fishes, and various homlogies are pointed out between muscles in Cypriniform and those in other fishes, especially Amia, Scomber, Perca and Esox.

TANAKA, SHIGEHO, 1925: A Study on the Distribution of Fishes in Japan. Suisan Ken-kyûshi, 12 (2), p. 53. (in Japanese).

The author says that the horizontal distribution of fishes is rather easily investigated. Most amateurs understand that the tropical and northern fishes are distributed with a distinct demarcation of the two, but in reality they are intermingled together and no definite dermacation can be recognized between them.

1926

FUJITA, KEISHIN, 1926: The effective Changes on the outer Features of *Hypomesus olidus* due to Translocation. Zool. Mag. 38 (453), pp. 186–194. (in Japanese).

The author has compared the specimens of *Hypomesus olidus* from Kasumigaura and the specimens of Suwa Lake, introduced from the former lake. The average water temperature of the two lakes is rather different being lower in the latter than the former. With respect to the growth of the fish, the latter fish have more rapid growth than the former. The lengths of head and dorsal and anal fins of the specimens from Suwa Lake are rather longer than those from Kasumigaura. From these facts, the water temperature and the amount of food may have been more effective on the outer features of the

fish since the translocation had been accomplished three years previously. Especially the length of head is noticed in Suwa Lake specimens. Furthermore the influence appears more distinct on the annual rings of the scales. In the Kasumigaura specimens, the scales have 33-36 rings above the nucleus and 4-6 rings below the nucleus while Suwa Lake specimens have 17-20 rings above and 11-12 rings below. The nucleus is located nearly in the center of the scale and large in size in Suwa Lake specimens. Anyhow the changes of head length may be adaptive for the different environments due to translocation. The significance of changing the ring formation of the scale is not clear.

FUJITA, KEISHIN, 1926: On the Nature exhibited by F. Breeding of the Salmonoid Fishes. Zool. Mag., 38 (448), pp. 39-51. (in Japanese).

The author made the interbreedings of *Oncorhynchus keta*, *Onc. masou* and *Onc. gorbuscha* in Nishibetsu Hatchery, Hokkaidô in 1925. The F1 hydrids indicate the intermediate form of three species. On the examination of 19 characters of 20 young hybrids measuring 5-6 cm. of body length, the two groups are distinguished. One is the group in which the parent characters appear more dominant than the sexual characters while the other group shows the sexual charactars more dominant than the parent characters. The specific dominant characters contain 16 external characters in 19 characters while the sexual dominant characters include 10 fatternal characters. As to the relation of specific characteres, the characters of *O. masou* are very important and dominant, appearing in the next generation. The characters of *O. gorbuscha* are more dominant than those of *O. keta*. The characters of *O. keta* are more recessive.

MATSUI, YOSHIICHI, 1926: Notes on the Albino of Fishes. Zool. Mag., 38 (448), p. 65. (in Japanese).

During the genetical experiments, he has found 28 albinos among 4229 individuals of Kigoi. They are quite pure white with red eyes. "Kigoi" (means yellow carp) from Mr. AKIYAMA the goldfish dealer at Fukagawa, Tôkyô was described as an albino of carp by Dr. KAMETARO TOYAMA, in 1910. This carp is yellow, with red eyes. The author also reported an albino eel from a fish culture station of Shizuoka Prefecture.

SASAKI, KIICHIRÔ, 1926: On the Sex Ratio in *Carassius auratus*. Sci. Rep. Tôhoku Univ.* Ser. 4, 1 (3), pp. 229-238.

The author tried to investigate the sex ratio of this fish living in a brook. He selected a branch of the OKADA canal, which is used for the irrigation at Minaminome, Haranomachi town, a suburb of Sendai. He collected all the fish found here, small and large, the total number of them being 423, of which 281 were from 4 to 6 cm. in length. The result of the examination gave the sex ratio of 11.6 males to 100 females (116 ♂ : 100 ♀).

1927

HÔZAWA, SANJI, 1927: Notes on an Iron Fish. Nihon Gakuzitsu Kyôkai Hôkoku, Vol. 3, pp. 280-287. (in Japanese).

This is a report of Iron Fish which is living in Uwotori Numa, Tashiro Dake, Miyazaki-mura, Kami-gun, Miyagi Prefecture, investigated by the author on June 13th in 1927. The iron-fish resembles *Carassius auratus* but the caudal fin, and other fins and nasal valve are much extended. The caudal fin bifurcate, trifurcate, quadrifurcate. The color is dark brown, often white, red, orange and black and with patterns as those of goldfish. This is distributed is Muzawaike, Higashi Tazawa, Nakahirauchi-mura, Higashi-Tsugaru-gun, Aomori Prefecture and Kuroshima, Ushimado, Ôku-gun, Okayama Prefecture. This bears a close resemblance to American Comet Goldfish, having a long body with a long fins and biforked long caudal fin.

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* Sci. Rep. Tôhoku Univ. = Science Report of Tôhoku University, published by the Zoological Institute of Tôhoku University, Sendai.

KAGOSHIMA FISHERIES EXPERIMENTAL STATION, 1927: A Catalogue of Fishes of Kagoshima Prefecture, published by the Kagoshima Fisheries Experimental Station, March 1927, pp. 1-60. (in Japanese).

Dr. K. UCHIDA made a list of fishes found in Kagoshima Prefecture, including many species, fourteen of which belong to the freshwater fishes.

1. *Eptatretus brugeri* (GIRARD).
2. *Coilia nasus* T. et SCH.
3. *Oncorhynchus masou* (BREVOORT).
4. *Plecoglossus altivelis* T. et SCH.
5. *Hypomesus olidus* (PALLAS).
6. *Parasilurus asotus* (L.)
7. *Misgurnus anguillicaudatus* (CANTOR).
8. *Leuciscus hakuensis* GÜNTHER.
9. *Cyprinus carpio* LINNAEUS.
10. *Carassius auratus* (L.).
11. *Anguilla japonica* T. et SCH.
12. *Oryzias latipes* (T. et SCH).
13. *Mugil cephalus* LINNAEUS.
14. *Cottus pollux* (GÜNTHER). ?

KAWAJIRI, MINORU, 1927: The Optimum Temperature of Water for the Hatching of the Eggs of Trout, *Oncorhynchus masou* (WALBAUM). Journ. Imp. Fish. Inst., 23 (2), 14-19.

The writer makes an experiment to determine the optimum temperature of water for the hatching of the eggs of *Oncorhynchus masou* (WALBAUM) and also how to study the relation between the temperature and days needed for the hatching. He concluds that the optimum temperature for the hatching of the eggs of this fish lies between 7°-11°C. The number of hatching days after fertilization decrease when the temperature rises. The formula representing the relation between the temperature and the rate of the development of fish eggs, $Te^{a\theta}=C$, can be applied in this case, and the following values are obtained: aloge=0.046, a=0.105, C=2.19, $Q_{10}=2.89$. In the optimum range of the temperature, the product of temperature and the hatching days is about 530°C.

KAWAJIRI, MINORU, 1927: On the Preservation of the Egg and Sperm of *Oncorhynchus masou*. Jour. Imp. Fish., 23 (2), pp. 11-13.

The writer wishes to know how long the egg and sperm of *Oncorhynchus masou* can keep their vitality and fertilizing ability after having been extruded from the body. These materiasl used in this experiments were extruded from the living trout which were caught in Lake Kizaki, Nagano Prefecture. The results of his experiment are as follows. The egg and sperm maintain the fertilizing power after having been kept during 24 hours within 1.0°-14.9°C. In the case of preservation for more than 48 hours, the sperm and egg lose their vitality. The relation between the duration of fertilizing power and the temperature may be represented by the following formula $Te^{a\theta}=C$. The temperature coefficient of the durability of fertilizing power of the egg and sperm of the trout is found in $Q_{10}=2.9$.

MORI, TAMEZÔ, 1927: Notes on the Genus *Sarcocheilichthys*, with the Descriptions of Four New Species. Ann. Zool. Jap., 11 (2), pp. 97-109.

The author revised Japanese Proper, Korean, Manchurian and Chinese freshwater *Sarcocheilchthys* by the systematic and descriptions.

1. *Sarcocheilichthys microcutus* MORI was described as a new species, obtained from Lake Biwa, Ôtsu. This has a long head and small eyes and is also provided with a narrow interorbital space and a fleshy or little horny symphysis.

2. *Sarcocheilichthys variegatus* is a common species found in central and southwestern Japan.

ONO, YOSHIAKI, 1927: The Behavior of Cells in Tissue Cultures of *Oryzias latipes* with special References to the Ectodermic Epithelium. Ann. Zool. Jap., 11 (2). pp. 145-149.

About the movement of epithelial cells, there has been a considerable diversity of opinions as to the precise method by which epithelial cells change their position and as to the causes of their migration. Two conclusions are (1) that their epithelium does not performs an amoeboid movement, though they change the position by the activities of the cells themselves; (2) that it is probably by means of

an amoeboid movement, by which the spreading and migration of epithelial cells are accomplished. He made many experiments and concluded: the actual growth of cells probably plays no part in the formation of the epithelial membrane, but does so in the production of the epithelial peninsula.

SAGO, GÔICHI, 1927: A Study on the Anatomy of Eel. (1). Suisangaku Zasshi,* No. 30, pp. 1-18. (in Japanese).

The writer makes an anatomy of Japanese eel. In this report, he describes only skin, skeleton, nervous system, and sense organs, with many figures.

TOZAWA, TOMIZYU, 1927: Notes on an Example of Castration of the Gold Fish and the Pearl Organ of the Gold-fish. Nihon Gakuzitsu Kyôkai Hôkoku, Vol. 3, pp. 418-421. (in Japanese).

The author makes some experiments upon the pearl organ after the castration in the gold-fish. The size of pearl organ ranges from 300μ to 700μ in height and it is corn-shaped, pointed at the top. The appearance is towards spring, just the beginning of breeding season. He observed that the 1st appearance in 1921 was the 29th of March, in 1922, March 29th, in 1923 the 24th of March, in 1924, the 25-th of March, and in 1925 it was the 26th of March. He makes also many experiments of castration cases with the three year goldfish. 1. castrated before the appearance of pearl organ. 2. castrated nearly in the middle of the breeding time. 3. castrated just before the breeding season. 4. castrated at the best breeding season. From these experiments, the appearance of pearl organs in the breeding season was found to be effected by the substance excreted from the testes.

UCHIDA, KEITARO, 1927: On the Formation and Fate of Kupffer's Vesicle. Jour. Coll. Agri. Imp. Univ. Tôkyô, 9 (3), pp. 159-169.

The author studies on the formation of Kupffer's vesicle of freshwater fishes *Oncorhynchus keta, Hypomesus olidus.* In the construction, the writer distinguishes two types, one complies bounded by a single cell-wall, the other with no cell-wall on the ventral side. The most of the fresh water fishes are recognized in the first type including *Salmo, Oncorhynchus, Salvelinus, Hypomesus, Carassius, Leuciscus, Abramus. Noturus.*

The writer also confirms that the freshwater fishes *Oncorhynchus keta* and *Hypomesus olidus* are belong to the first type.

1928

AMEMIYA, IKUSAKU, 1928: Eggs of *Oryzias latipes* for Biological Teaching. Tôyô Gakugeizashi,** 44 (8), pp. 571-579. (in Japanese).

The author studied the outer features, hatching, general nature, developmental stages and rare phenomena of the eggs because they are very useful as biological material for teaching. 1.) To keep the fresh-eggs easily in the laboratory. 2.) To observe the egg-development easily in the laboratory. 3). To observe the egg construction. 4). To observe the developmental stages of the embryo. 5). Typical of the development of Teleostean fishes. 6). Suitable material for experiments with toxic substances and other problems of physiological studies.

GIFU PREFECTURE FISHERIES EXPERIMENTAL STATION, 1928: Food Habits of *Tribolodon hakuensis.* Report of the Tenth Research Congress of Freshwater Fishculture, Fisheries Experimental Station of Gifu Prefecture. pp. 310-321,

The food habits of *Tribolon hakuensis* were studied by the authorites of the Gifu Prefecture fisheries Experimental Station. The materials were obtained from Kasu River, Hikikasugamura, Rokugo, Gifu

* Suisangaku Zasshi = Fisheries Magazine published by the Fisheries Institute of Hakodate Fisheries College, Hokkaidô.

** Tôyô Gakugeizasshi = Scientific Magazine of Asia, published by Shôkabo Co. Ltd. Tôkyô.

Prefecture from April 25 to June 18 in 1928. Most of the stomach contents indicate the main diet to consist of small crustaceans and the larva of water insects. Very few of the examples showed the presence of micro-algae or her own eggs.

KAMITO, AKIRA, 1928: Early Development of the Japanese Killifish (*Oryzias latipes*), with Notes on its Habits. Jour. Coll. Agr. Imp. Univ. Tôkyô, 10, 1, pp. 21-38.

The general character, habits and development of the very common Japanese Killifish was studied by the author. The author summarized the following results. The sexual difference appears in the size of the anal and dorsal fins, being larger in male than in female. The breeding season extends over some months from the end of April to September or to October. The number of eggs laid during the breeding season by one female was 500-800 in all. The egg is 1.27 mm. in diameter, with sticky filaments outside. The cleavage is normal, lst plane is meridional, the 2nd meridional but perpendicular to the first; the 3rd vertical but parallel to the first. The one day old embryo has the optic capsule, and the KUPFFER's vesicle appears in the tail region. In the three day old embryo, the pigments appear in the optic capsule. On the fourth day, the embryo begins to move within the egg membrane. The pectoral fins appear about two or three days before hatching. In the summer the embryos hatch on the eighth day.

MIYADI, DENZABURÔ, 1928: Fishes of Lake Biwa. Suisan Ken-kyûshi 23(8), pp. 266-271. (in Japanese).

On account of their inveistgations of TEMMINCK, SCHLEGEL, SAUVAGE, JORDAN, ISHIKAWA and TANAKA, the fishes of Lake Biwa are numbered 51 species under 37 genera up to the present. A quite endemic species is *Chaenogobius isazà* TANAKA. Undoubtful species are *Fundulichthys virescens* (T. et SCH.), *Otakia rasborina rasborina* JORDAN et SNYDER, *Gnathopogon caerulescens* (SAUVAGE), *Oncorhynchus ishikawae* JORDAN et MCGREGOR, *Acheilognathus intermedia* (T. et SCH.), *Acheilognathus tabira* JORDAN et THOMPSON and *Acheilognathus moriokae* JORDAN et THOMPSON. Three species above mentioned are somewhat indefinite in the classification and distribution by many preceding authors. Furthermore, *Ishikauia steenackeri* (SAUVAGE) *Acheilognathus longipinnis* REGAN, *Gnathopogon caerulescens* (SAUVAGE), *Hymenophysa curta* (T. et SCH.) may be characteristic species in Lake Biwa and its tributaries. *Opsarüchthys uncirostris* (T. et SCH.) is peculiar in the Hasu River of Lake Mikata and Lake Biwa.

Biwia zezera ISHIKAWA is also said to be peculiar in this lake and in the Asahi River, Okayama Prefecture. *Bryttosus kawamebari* (T. et SCH.), *Biwia zezera* ISHIKAWA, *Hemigrammocypris rasborella* FOWLER (=*Brevigobio kawabatae* TANAKA) are southern species, distributed in southern part of Honshû, with a demarcation of Lake Biwa and the Yodo River. *Belligobio eristigma* JORDAN et HUBBS is found in the Yoshino River, the Eno River and the Yura River but not in the Yodo River and Lake Biwa. From these facts, Lake Biwa may be indicated as a demarcation line for the distribution of freshwater fishes in Japan.

In Lake Biwa, the distribution of fishes somewhat different in each species. *Chaenogobius isaza* (TANAKA), mostly lived in the deep northern region of the lake, and not found in southern part to supply food for Salomonids fishes of Lake Biwa and fished abundantly during winter. *Pelteobagrus nudiceps* (SAUVAGE) comes to shallow water during rainy and breeding seasons. The youngs are caught at very deep water during winter. *Salvelinus pluvius* (HILGENDORF), *Moroco steindachneri* and *Liobagrus reini* HILGENDORF are mostly caught in the estuaries and not in lake. *Chaenogobius macrognathus* (BLEEKER) and *Rhinogobius similis* GILL are found along the coast of the lake and *Rhodeus smithi* (REGAN), *Acheilognathus cyanostigma* JORDAN et FOWLER, *Gasterosteus aculeatus microcephalus* (GIRARD), *Lefua echigonia* JORDAN et RICHARDSON, and *Oryzias latipes* (T. et SCH.) are mostly obtained in inland bay of Lake Biwa. *Plecoglossus altivelis*, one of the important dwarf fishes of Lake Biwa, the originated there after the connection of lower river and lake were intercepted by fish channel of Nango. That fish became quite a land-rocked form and breeds in the lake. The same phenomenon on the transplanted *Plecoglossus altivelis* can be observed in Lake Ikeda and Unagi Ike which have no outlets. If we tansported them into rivers of several districts, they grow rapidly into large size.

Salmo shasta JORDAN was imported from California, U. S. A. and *Gambusia affinis* (BAIRD et GIRARD) was also imported through Hawaii Island, and Formosa to kill the malarial mosquito larvae. Recently the top-minnow is breeding in Hikone district but disappeared in Lake Biwa. *Oncorhynchus keta* (WALBAUM), *Coregonus albus* LE SUER and *Hypomesus olidus* (PALLAS) disappeared in Lake Biwa after transportation.

He finally listed the fishes found in Lake Biwa

1. *Entosphenus mitsukurii* (HATTA). "Sunayatsume"
2. *Oncorhynchus ishikawae* JORDAN et MCGREGOR. "Yamame"
3. *Oncorhynchus macrostomus* (GÜNTHER). "Amago"
4. *Oncorhynchus rhodurus* JORDAN et MCGREGOR. "Masu"
5. *Salmo shasta* JORDAN. "Nizimasu"
6. *Salvelinus pluvius* (HILGENDORF). "Iwana"
7. *Plecoglossus altivelis* T. et SCH. "Ayu"
8. *Parasilurus asotus* (LINNAEUS). "Namazu"
9. *Pelteobagrus nudiceps* (SAUVAGE). "Hagegigi"
10. *Liobagrus reini* HILGENDORF. "Akaza"
11. *Misgurnus anguillicaudatus* (CANTOR). "Dozyo"
12. *Lefua echigonia* JORDAN et RICHARDSON. "Hotokedozyo"
13. *Cobitis biwae* (JORDAN et FOWLER). "Shimadozyo"
14. *Hymenophysa curta* (T. et SCH.). "Ayumodoki"
15. *Rhodeus smithi* (REGAN). "Baratanago"
16. *Acheilognathus rhombea* (T. et SCH.). "Kanehira"
17. *Ach. tabira* JORDAN et THOMPSON. "Tabira"
18. *Ach. intermedia* (T. et SCH.). "Bote"
19. *Ach. lanceolata* (T. et SCH.). "Yaritanago"
20. *Ach. limbata* (T. et SCH.). "Aburabote"
21. *Ach. cyanostigma* REGAN et FOWLER. "Ichimonzitanago"
22. *Ach. longipinnis* REGAN. "Biwatanago"
23. *Sarcocheilichthys variegatus* (T. et SCH.). "Higai"
24. *Abbottina psegma* (JORDAN et FOWLER). "Tsuchihuki"
25. *Pungtungia hilgendorfii* (ISHIKAWA). "Mugitsuku"
26. *Gnathopogon elongatus* (T. et SCH.). "Tamoroko"
27. *G. caerulescens* (SAUVAGE). "Yamagimoroko"
28. *G. gracilis* (T. et SCH.). "Itomoroko"
29. *G. japonicus* (SAUVAGE). "Honmoroko"
30. *G. biwae* (JORDAN et SNYDER). "Sugomoroko"
31. *Pseudogobio esocinus* (T. et SCH.). "Kamatsuka"
32. *Hemibarbus barbus* (T. et SCH). "Nigoi"
33. *Biwia zezera* (ISHIKAWA). "Zezera"
34. *Pseudorasbora parva* (T. et SCH.). "Ishimoroko"
35. *Acahara hakonensis* (GÜNTHER). "Ugui"
36. *Moroco steindachneri* (SAUVAGE). "Aburahai"
37. *Zacco platypus* (T. et SCH.). "Haya"
38. *Zacco temmincki* (T. et SCH.). "Mutsu"
39. *Opsariichthys uncirostris* (T. et SCH.). "Hasu"
40. *Ishikauia steenackeri* (SAUVAGE). "Wataka"
41. *Hemigramocypris rasborella* FOWLER. "Kawabata moroko"
42. *Carassius auratus* (LINNAEUS). "Huna"
43. *Cyprinus carpio* LINNAEUS. "Koi"
44. *Anguilla japonica* T. et SCH. "Unagi"
45. *Oryzias latipes* (T. et SCH.). "Medaka"

* 46. *Gambusia affini* (BAIRD et GIRARD). "Kadayashi"
47. *Gasterostus aculeatus microcephalus* (GIRARD). "Hariuwo"
48. *Pungitius kaibarae* (TANAKA). "Sabazyako"
49. *Brytosus kawamebari* (T. et SCH.). "Oyanirami"
50. *Cottus pollux* GÜNTHER. "Kazika"
51. *Odontobutis obscurus* (T. et SCH.). "Donko"
52. *Rhinogobius similis* GILL. "Yoshinobori"
53. *Chaenogobius macrognathus* (BLEEKER). "Ukigori"
* 54. *Chaenogobius isaza* TANAKA. "Isaza"

* introduced species.

From the list of above mentioned we could recognized that the fishes of Lake Biwa occupied nearly half of the fishes of Japan. In Japan, about 127 species of freshwater fishes are found and 54 species are in Lake Biwa. Here we compared the number of freshwater fishes from many lakes of Japan with those found in Lake Biwa.

I. Volcanic lakes in Hokkaidô (on account of Dr. SHÛZÔ, TANAKADATE)

1. Onuma and Konuma	6 families	8 species
2. Akan Lake	6 〃	8 〃
3. Hangetsu Lake	3 〃	4 〃

II. Towada Lake (Aomori Prefecture and Akita Prefecture (on account of AKAMARO, TANAKA) all were introduced.

III. Tazawa Lake (Akita Prefecture) (on account of AKAMARO, TANAKA) 14 species (11 spp. were introduced)

IV. Shinai Numa (Miyagi Prefecture): 5 families 11 spp.

V. Noziri Lake (Nagano Prefecture) (on account of AKAMARO, TANAKA): 10 families 15 species.

VI. Kizaki Lake (by MIYADI's collection): 8 families 19 spp. 3 of these are recently introduced.

VII. Suwa Lake (Nagano Prefecture, by MIYADI's collection): 8 families 19 spp. 3 of these are introduced. *Pseudoperilampus* BLEEKER was also introduced spontaneously from Kasumigaura together with freshwater mussel *Anodonta.*

VIII. Biwa Lake (Shiga Prefecture, by MIYADI's collection): 14 families 51 spp. 3 of these were introduced.

IX. Ogura pond (Kyoto-fu, by MIYADI's collection): 13 families, 47 spp. This pond is connected with Yodo River to Lake Biwa and has a nearly similar fish fauna to that of Lake Biwa excepting *Chaenogobius isaza.*

X. Kozan Pond (Tottori Prefecture, by MIYADI's collection): 15 families, 26 spp. As this lake brakish, *Hyporhamphus kurumeus* JORDAN et STARKS, *Mugil cephalus* LINNAEUS and *Lateolabrax japonicus* (CUVIER et VALENCIENNES) are existing.

XI. Kirishima Onike (Miyazaki Prefecture by MIYADI's collection): 1 family, 3 spp. Once *Salmo shasta* JORDAN has been transplanted but now quite extinct.

XII. Onami Pond (Kagoshima Prefecture) 1 family 1 sp. *Cyprinus carpio* has been introduced.

XIII. Ikeda Lake (Kagoshima Prefecture): 5 families 7 spp. 4 species of these were recently introduced Salmonid fishes are quite extinct at present.

JORDAN, D. S. and MCGREGOR established a new speciee of *Oncorhynchus adonis* for *Oncorhynchus nerka* of Lake Kizaki but the author does not agree with them, as that fish was introduced from Akan-ko. At the end of his report, he listed 22 species from the specimens found in Kizaki Lake.

Salmonidae:
Oncorhynchus rhodurus JORDAN et MCGREGOR.
〃 *macrostomus* (GÜNTHER).
〃 *nerka* (WALBAUM).
Salvelinus pluvius (HILGENDORF).
Osmeridae:
Hypomesus olidus (PALLAS).
Siluridae:
Parasilurus asotus (LINNAEUS).
Bagridae:
Liobagrus reini (HILGENDORF).
Cyprinidae:
Acheilognathus tabira JORDAN et THOMPSON.
Ach. lanceolatus (TEMMINCK et SCHLEGEL).

Gnathopogon suwae JORDAN et HUBBS.
Pseudogobio esocinus (TEMMINCK et SCHLEGEL).
Acahara hakonensis (GÜNTHER).
Sarcocheilichthys variegatus (TEMMINCK et SCHLEGEL).
Moroco steindachneri (SAUVAGE).
Hemibarbus barbus (TEMMINCK et SCHLEGEL).
Zacco platypus (TEMMINCK et SCHLEGEL).
Carassius auratus (LNNAEUS).
Cyprinus carpio (LINNAEUS).
Cobitidae:
Misgurnus anguillicaudatus (CANTOR).
Anguilidae:
Anguillia japonica TEMMINCK et SCHLEGEL.
Cottidae:
Cottus pollux (GÜNTHER).
Gobüdae:
Rhinogobius similis (GILL).

TAN, NOBUZANE, 1928: Einige Beobachtungen über *Pygosteus kaibarae* TANAKA. pp. 1-41, published himself (in Japanese).

The writer makes a detailed observation of *Pygosteus kaibarae* which is distributed in a very extreme area around Kyôto City. He describes the outer feature, internal organs, ecology including the fighting, nesting, spawning, development and conservation of the species.

TOZAWA, TOMIZYU, 1928: Notes on a Nuptial Color and Pearl Organs of the Male Goldfish. Nihon Gakuzitsu Kyôkai Hôkoku, Vol. 4, pp. 494–501. (in Japanese).

The author makes many experiments on the castration of the male *Acheilognathus lanceolatus* and how it changes the nuptial color and pearl organs of the male goldfish. The nuptial color appears in the breeding females. Very light pinkish color appears on the dorsal and anal fins. But in the male, the entire body is blackish and deep red on the head, opercle, body side, tail, dorsal fin and caudal fin. Blue color appears on the posterior half of the trunk. These color changes are quite recognized as a secondary sexual characters. He makes an experiment of extirpation of testes before the breeding season, this secondarily sexual characters will not appear in sexual adults. Perhaps, the hormone which was produced from sexual glands will make the great influence on the apparance of nuptial color in the male.

YOSHIYUKI, TORYU, 1928: The Respiratory Exchange in *Carassius auratus* and the Gaseous Exchange of the Air Bladder. Sci. Rep. Tôhoku Imp. Univ., 3 (1), pp. 87-96.

The author studies on the relation of the oxygen consumption and the carbon dioxide output from normal conditions to the point of death, especially with the changes in the gaseous content of the air bladder during asphyxiation. On the idea above, he makes many experiments and concludes as follows. The air bladder of *Carassius auratus* contains oxygen, the amount of which is lower than that in the atmospheric air. The oxygen in the air bladder is utilized when the oxygen tension in the medium is greatly decreased. The rate of oxygen consumption of *Carassius* is independent of the oxygen tension till the pressure is reduced to 0.2 or below. The carbon dioxide output is parallel to the oxygen consumption. While the oxygen consumption is almost nothing, the carbon dioxide increases steadily during asphyxiation and this increase is roughly proportional to the length of time of asphyxiation. The nitrogen content shows little change during asphyxiation.

1929

EBINA, KENICHI, 1929: Nuptial Organ of the Salmonoid Fish, *Plecoglossus altivelis* T. et S. Jour. Fish. Inst., 25 (2), pp. 23–25.

From the histological and ecological observations of the pearl organs of *Plecoglossus altivelis*, the author has renamed them as nupital organs with the following definition. The nuptial organ is an integumentary structures occurring in fishes during the breeding season, either characteristic to male or common in both sexes, and often related at varying degrees with the nuptial colouration.

GUDGER, E. W., 1929: Fishing with the Cormorant in Japan. Scie. Monthly, 29, pp. 5–38.

The author introduces the peculiar cormorant fishing in the River Nagara, Gifu Prefecture.

KAWAMOTO, NOBUYUKI, 1929: Physiological Studies on Eel. I. The Seasnoal Variation of the Blood Constituents. Sci. Rep. Tôhoku Imp. Univ., 4 (4), pp. 635-641.

The blood constitution of fishes shows some alternation by asphyxation and the decrease in the blood corpuscles in fishes during winter. The author undertakes to determine whether or not our anticipation as to the influence of seasonal variations to the blood constituents of eel would be realized. The seasonal variation, as he surmised, is indicated by the changes in the constituents of blood of eels. Non-protein nitrogen in the blood may be taken as an index of metaboli activity. Relative volume, number of corpuscles, viscosity and iron content gradually decrease during winter till these begin to rise considerably at the beginning of hibernation but decrease again in the spring. From the present study, such seasonal variation of the blood constituents may be partly responsible for the variations of blood gasses noted by other investigators.

KAWAMOTO, NOBUYUKI, 1929: Physiological Studies on the Eel. II. The Influence of Temperature and of the Relative Volumes of the Red Corpuscles and Plasma upon the Haemoglobim Dissociation Curve. Sci. Rep. Tôhoku., Imp. Univ., 4 (3) pp. 643-659.

The author reports that the haemoglobin dissociation curve of the blood of eel is evidently influenced by the variations of its constitution as well as by the variation of temperature. After many experiments, he concluded as follows. The hydrogen ion concentration of the blood of the eel was found to be constant during the 43 days of starvation. The standard value of the relative volume of red corpuscles was determined in his experiment as 39%. The oxygen capacity of the blood is directly proportional to the reative volume of red corpuscles within the limit of 23 to 53 percent. That greater amount of heat produced chemical reaction between oxygen and haemoglobin may be taken to mean that the blood of the eel possesses greater affinity for oxygen than that of the frog and human blood.

MIYADI, DENZABURÔ, 1929: Notes on the Skin and Cutaneous Sense Organs of some Cobitoid and Gasteroid Fishes, with special Reference to the Rudimentary Nature of the Lateral Canal System. Mem. Coll. Sci. Kyôto, Imp. Univ.,* B, IV, No. 2, Art. 4, pp. 81-96.

The author observed that on a Japanese stickleback, *Pungitius kaibarae*, the canal system is developed on the trunk as well as on the head, and ontogenetically the canal of the head appears earlier than that of the trunk. He has also noticed some new examples of Cobitoid fishes in which the canal system is developed in the anterior portion of the trunk only, and not on the head. In the skin of *Misgurnus anguillicaudaus*, he found various interesting figures, which he shall interpret as remnants and vestiges of the canal system.

NAKAYAMA, OTONE, 1929: Freshwater Fishes from the Coast of Kuzyûkuri Hama. Hakubutsugaku Zasshi,** 38, pp. 47-48. (in Japanese).

During 1924 and 1926, the author collected fresh- and brackish-water fishes from Kaijo-gun, Sambu-gun, situated along the coast of Kuzyukuri Hama, Chiba Prefecture.

Entosphenus misukurii. "Sunayatsume" Sakuta River, Sambu-gun.
Misgurnus anguillicaudatus. "Dojo"
Cobitis biwae. "Shimadojo"
Lefua echigonia. "Hotokedojo"
Anguilla japonica. "Unagi"
Cyprinus carpio. "Koi"
Carassius auratus. "Funa"
Macropodes opercularis. "Chosenbuma" Ichikawa, Higashikatsushiro-gun.
Acheilognathus cyanostigma. "Yaritanago"
Acheilognathus limbata. "Zenitanago"

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* Mem. Coll. Sci. Kyôto. Imp. Univ. = Memoire of the College of Science, Kyôto Imperial University, Kyôto.

** Hakubutsugaku Zasshi = Natural History Magazine published by the Society of Natural History, attached to the Tôkyô Normal High School, Tôkyô.

Acheilognathus intermedia. "Tanago"
Acheilognathus miyobuta. "Miyobuta", Hiuga-mura, Sanbu-gun.
Hemibarbus barbus. "Nigoi", Ichikawa Machi, Higashikatsushiro-gun.
Pseudogobio esocinus. "Kamatsuka", the River Tone, the River Edo.
Preudorasbora parva. "Motsugo"
Zacco platypus. "Oikawa"
Tribolodon hakuensis. "Ugui", the River Tone, the River Edo
Aplocheilus latipes. "Medaka"
Hemirhamphus sajori. "Sayori", the River Tone, the Edo River, the Esumi River.
Lateolabrax japonicus. "Suzuki"
Mugil cephalus "Bora"
Plecoglossus altivelis. "Ayu", the Sakuta River, Sanbu-gun.
Hypomesus olidus. "Wakasagi", the Tone River, the Sakuta River.
Parasilurus asotus. "Namazu"
Pelteobagrus nudiceps. "Gibachi"
Gobius giurinus. "Gokurakuhaze" Sanbu-gun
G. simlis ."Yoshinobori"
Tridentiger obscurus obscurus (T. et Sch.). "Titibu"

SASAKI, KIICHIRÔ, 1929: An Example of Hermaphroditic *Oncorhynchus keta* (WALBAUM) in Japan. Zool. Mag., 41 (487), pp. 233–234. (in Japanese).

The writer pointed out a hermaphrodite of Salmon which was caught at a spot off Uchimura, Horonai Mura, Kitami Province, Hokkaidô. The specimen measures 119 mm. in length and 50 mm. in breadth. The right side of the body is occupied by ovary and a testis at the anterior cup. The entire length of gonad is 101 mm. and 31 .mm is the breadth. The diameter of egg is 4–5 mm. Generally in this specimen, the gonad is not so well developed as in a normal specimen.

SATÔ, GENZABURÔ, 1929: A Striped Bass transported from California into Japan. Suisan-Kenkyû-shi, 24 (5), pp. 121–124. (in Japanese).

The author has made the second experiments for the transplantation of a Striped Bass (*Roccus lineatus* BLOCK) from California in 1927 and 1928. He makes a note on migration and habits, spawning, rate of growth, food and the commercial value studied in the United States of America.

TANAKA, SHIGEO, 1929: Marsipobranchii and Pisces Fauna Musashinensis* No. 1, Musashi High School, Tôkyo. Art. 2, pp. 39–41.

The writer mentions 16 species of freshwater fishes around the Musashi High School. The species are as follows.

1. *Lampetra planeri.*
2. *Parasilurus asotus.*
3. *Pseudobagrus aurantiacus.*
4. *Misgurnus anguillicaudatus.*
5. *Cobitis taenia.*
6. *Lefua echigonia.*
7. *Acheilognathus lanceolatum.*
8. *Acheilognathus moriokae.*
9. *Zacco platypus.*
10. *Pseudorasbora parva.*
11. *Carassius auratus.*
12. *Cyprinus carpio.*
13. *Anguilla japonica.*
14. *Oryzias latipes.*
15. *Pygosteus sinensis.*
16. *Chloea castanea.*

TANAKA, SHIGEO, 1929: The Distribution of Fish in Japan. Zool. Mag., 41 (488), pp. 278–293. (in Japanese).

In this report, the writer mostly treated marine fishes. The interesting topics may be the remarkable notice for the distribution of fishes, the distribution of marine fishes, the special marine fishes of south Japan and the special marine fishes of north Japan as well as the fishes of both south and north parts of Japan.

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* Fauna Musashiensis = Special Report of the Fauna of Musashi District around Tôkyo Musashi High School published by the Musashi High School.

TANAKA, SHIGEO, 1929: A Classifical Relation of "Yamame" and "Masu" and their Scientific Names. Zool. Mag., 41 (494), pp. 489-499. (in Japanese)

In 1904, Mr. TASAKU, KITAHARA reported that the "Yamame" is a landlocked form and in 1902, JORDAN and SNYDER reported on this fish in "A Review of the Salmonoid Fishes of Japan". In 1907, Mr. KATSUYA, TAGO distinguishes both sexes in "Yamame". The author has some suspicion for the scientific name of this fish. He distinguishes two forms; one is northern and other is southern forms. The northern form has no red spot on the body side while the southern form has many red spots which are sometimes fading in formalin preserved specimens. The distributional demarcation of the two forms is different, indicating the northern limit of the southern form is shown in a right branch of the River Sagami. The northern form is distributed in Hokkaidô and Tôhoku District, including the River Tone, the River Tama and the upper stream and the branch of the River Sagami. On the Japan Sea side, the demarcation of the two southern and northern forms is found between Shimane Prefecture and Tottori Prefecture. From these facts above said, the author proposes to call them by scientific name as follows.

1. Typical and Sea-run form, "Masu" = *Oncorhynchus kisutch* (WALBAUM) or *O. milktschitch* (WALBAUM).

2. Mountain brook form of northern Japan, "Yamabe" = *Oncorhynchus kisutch* (WALBAUM) or *O. milktschitsch* (WALBAUM).

TOZAWA, TOMIZYU, 1929: Experiments on the Development of the Nuptial Coloration and Pearl Organs of the Japanese Bitterling. Folia Anat. Jap.,* 7 (4), pp. 407-417.

The author makes a gonadectomy of Japanese Bitterling *Acheilognathus intermedium* to relate the secondary sexual characters. The male fishes during the breeding season acquire nuptial coloration which lasts for 30 to 70 days. Melanophores differ in number and with sex. If gonadectary was performed before the appearance of nuptial coloration, it was retorded. If the operation was done during the breeding season, in most of the fishes the nuptial color appeared in spite of the operation. If the fishes are gonadectomied during the period of highest development of the nuptial coloration, it disappeared earlier than in unoperated fishes.

Pearl organs are found in a small group only at the tip of the head immediately anterior to the nostril. They appear in the breeding season and disappear earlier than the nuptial coloration. Gonadoctomy retards or inhibits the appearanse of the pearl organs. From all the experiments, the writer concludes that the appearance of the nuptial coloration and the formation of the pearl organs are influenced by the substances produced by the sex glands.

TSUGE, HIDEOMI, 1929: The Fiber Tracts of the Cerebrum to *Carassius auratus* (L.). Sci. Rep. Tôhoku Imp. Univ., 4 (3), pp. 481-520.

Carassius auratus, one of the commonest freshwater fish in Japan has three forms; gold-fish (a variety of real cruscian carp), *Tetsugyo* (Iron-fish, which is distributed in isolated districts of Japan) and real Cruscian carp. These are assumed to be geneticaly closely related to one another. The author undertakes to study the brains of these three forms of fishes. He supposes that the *Carassius auratus* is usually believed to be the ancestral forms mentioned above. In this report, he has limited his observation to the principal fiber tracts of the cerebrum, including the praethalanus of C. L. HERRICK reserving those belonging to the other divisions. The chief conclusion made by him is as follows. In *Carassius auratus* (L.), the fissures which run above the cerebral hemispheres are not so distinct as in carp. The differentiation of the nucleus pyriformis and the nucleus olfactorius is more difficult in *Carassius auratus* (L.) than in the carp. At the rostral end of the basal lobe, there is no distinction between the tractus olfactorius ascendence and the tractus olfactorius medialis pars lateralis within the tractus olfactorius medialis as is shown in carp. The fibers of the tractus olfactorius medialis pars lateralis

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* Folia Anat. Jap. = Folia Anatomica Japan, published by the Anatomical Department of Keiô Medical University, Tôkyô.

do not end in the nucleus olfactorius dorsalis. Almost all of the fibers of the commissure olfactoria internuclearis are composed of medullated fibers. The tractus olfacto-hypothalamicus lateralis is not so distinct as in carp. The fibers of the tractus striothalamicus and in a smaller area of the hypothalamus than in carp. The fibers of the tractus teniae are distinctly more medullated than those of the carp.

1930

AMEMIYA, IKUSAKU, and NAKAMURA, HIROSHI, 1930: On the Sexual Dimorphism exhibited in Rigor Mortis in a Fish, *Hypomesus olidus* (PALLAS). Jap. Journ. Zool.,* 3 (5), pp. 299-301.

No one has ever noted the sexual dimorphism exhibited in rigor mortis in fishes. During his study of the fish, on a certain day in March, 1930 at Lake Suwa, a fairly large number was colected. In the meantime all died from suffocation and became stiffened; so they are preserved in alcohol. A brief, causal inspection at once showed that the males had their mouths wide open, while females had them closed utterly; so that the sexes could be easily distinguished without further examination.

AMEMIYA, IKUSAKU and MARUYAMA, SABURÔ, 1930: Some Remarks on the Existence of developing Embryos in the Body and an oviparous Cyprinodont, *Oryzias* (*Aplocheilus*) *latipes* (TEMMINCK et SCHLEGEL). Proc. Imper. Acad.** 7 (4), pp. 176-178.

The author has infrequently found developing embryos in the interior of a female *Oryzias latipes*. Generally the fertilization of the eggs and their development are performed out of the parent's body but rarely it occurs in the interior of the parent's body and the development proceeds to some degree. From these facts, the present species although normally oviparous, is the transitional form between the oviparous and the viviparous types. He was very interested in the fact that there is a rhythmical undulating movement of the blastoderm in the early embryonal stage. This movement has never been observed in other teleostean embryos.

HIKITA, TOYOHARU, 1930: Studies on the Morphology, Habitats and Distriibution of *Osmerus lanceolatus* HIKITA in Hokkaidô and *Mallotus villosus* CUVIER in Karafuto. Zool. Mag., 42 (503), pp. 358-359. (in Japanese).

The writer distinguishes two species *Osmerus lanceolatus* and *Mallotus villosus* in the northern part of Japan. The former species is found in a group along the shallow sea of Hokkaidô ascending to the River Mukawa around the 3rd of November and to the rivers Ôtsu and Tokachi around the 5th of November. The spawning ground is located at a spot 10 miles up from the river mouth in the former case and 4 miles in the latter case. They deposit eggs in the sandy grounds of the rivers. After spawning, they descend directly into the sea. It is distributed in the shallow waters of the south-eastern part of Hokkaidô and in the River Yurup, Oshima Province; the River Mukawa, Iburi Province; the River Saru, Hidaka Province; the River Tokachi and Ôtsu, Tokachi Province and the River Kushiro, Kushiro Province. The latter species distributed along the coast of Sachalien and Tôhutsu, Kitami, Hokkaidô.

HOKKAIDÔ FISHERIES INSTITUTION, 1930: Researches of the Lakes in Hokkaidô. Ônuma, Junsainuma, Akanko and Tofutsu-numa. Suisan Chôsa Hôkoku,*** Vol. 21, pp. 1-117. (in Japanese).

The Hokkaidô Fisheries Institution makes a survey of many lakes in Hokkaidô for the hydrobiological, Biological and Fisheries. In their descriptions, many freshwater fishes of lakes are listed and

* Jap. Journ. Zool. = Japanese Journal of Zoology, published by the Japanese Scientific Association, Tôkyô.

** Proc. Imp. Acad. = Proceedings of the Imperial Academy, published by the Imperial Academy, Tôkyô.

*** Suisan Chôsa Hôkoku = Report of the Hokkaidô Fisheries Institution, published by the Hokkaidô Fisheies Institution, Yoichi, Hokkaidô.

here we make them into a list of fishes. In Onuma, Konuma, Junsainuma, there are found *Cyprinus carpio, Carassius auratus, Misgurnus anguillicaudatus, Hypomesus oildus, Anguilla japonica.* In the lake of Akanko, *Oncorhynchus nerka, Salvelinus kundscha, Leuciscus hakuensis, Hucho blackistoni, Cottus pollux.* In the lake of Tofutsu Numa, there are many fishes: *Hypomesus japonica, Hucho blackistoni, Salvelinus kundscha, Salangichthys microdon, Clupea pallasii, Gasterosteus cataphlactus, Eleginus navoga, Hyporhamphus sajori, Limanda schrencki, Platichthys stellotus, Scomber japonicus, Leuciscus hakuensis, Liza menada, Aboma lactipes, Chloea castanea, Entosphenus japonicus, Syngnathus schlegeli, Pygosteus sinensis, Pandalus platyceros.*

HOKKAIDÔ FISHERIES INSTITUTION, 1930: Researches of the Lakes in Hokkaidô Abashiri Lake, Toroko and Komukai Numa. Suisan Chôsa Hôkoku, Vol. 22, pp. 1-92. (in Japanese).

The authors describe many freshwater fishes in Lake Abashri. *Hypomesus olidus, Hucho blackistoni, Salvelinus kundscha, Eleginus navoge, Platichthys stellotus, Leuciscus hakuensis, Osmerus dentex, Liza menada, Lampetra planeli, Carassius auratus, Cyprinus carpio, Pygosteus sinensis, Gasterosteus macrognathus, Aboma lactipes, Cloea castanea, Tridentiger obscurus.* In Tôroko, the authors found the following species. *Gastrosteus cataphractus, Pygosteus sinensis, Hucho blackistoni, Salvelinus pluvius, Anguilla japonica, Cyprinus carpio, Carassius auratus, Leuciscus hakuensis, Platichthys stellatus, Acipenser mikadoi, Chaenogobius macrognathos, Hypomesus olidus, Tridentiger obscurus, Chloea castanea,* In Komukai-numa, the authors found the following species to describe: *Sebastodes fuscescens, Chaenogobius macrognathus, Paralichthys olivaccus, Kareius bicolatus, Platichthys stellatus, Hypomesus olidus, Liza menada, Leuciscus hakuensis, Salangichthys microdon, Gasterosteus cataphlactus, Pygosteus sinensis, Hyporhamphus sajori, Salvelinus pluvius, Cloea catanea, Aboma lactipes, Lefua nikkonis.*

KANDA, SHIGEO, 1930: Yellow *Parasilurus asotus.* Zool. Mag., 42 (499), pp. 197-198. (in Japanese).

The author found a yellow *Parasilurus asotus* at Kaizuka-Nura, Takai-mura, Shimoosa Province, Chiba Prefecture. It is quite yellow with black spots on head and tail. This color phase frequently occurs in the swamp but the causative factor is not yet resolved. The people of this disrict do not like to eat a yellow one.

KAWANOTO, NOBUYUKI, 1930: Studies on Eel. Zool. Mag., 42 (495), pp. 1-6. (in Japanese).

Hê made a summary as follows. I. Pri la sezona ŝanĝiĝo de la sangelementoj ĉe Angilo.

Kelkaj studantoj antaŭ nelonge raportis, ke la sangelementoj ĉe fiŝoj ŝanĝiĝas laŭ sezono, pro asfiksio kaj aliaj kaŭzoj. Krom la raporto de HALL (1928) oni tamen preskau ne scias studanton, kiu studis ĉe fiŝoj la ŝanĝiĝon de sanggasoj pro la kauzoj supre diritaj. Ĉt tiu verko estis entreprenita kiel prepara studo pri la sanggasoj pro vidi, ĉu la laŭsezona sanĝiĝo de sangelementoj ekzistus ce angilo. La rezulto pozitive montris ekziston de ŝanĝiĝo de la sangelementoj ĉe angilo. Restazoto en la sango pliiĝas au malpliiĝas paralele kun la variedo de temperaturo de akvo kaj la nombro de ruĝaj korpetoj, ilia relativa volumeno, viskozeco de sango kaj enhavo de fero en sango pliiĝas tuj post la kome nco de vintra dormado kaj rapide atingas la maksimumon, por ree malpliiĝi iom post iom; ili tamen restarigas al normala veloro ĉe la plialtiĝo de temperaturo en la printempo. Laŭ ĉi tiu studo oni scias, ke oni devas ciam atenti la laŭsezonan ŝanĝiĝon de sangelementoj ĉe la studo de sanggasoj de angilo.

MATSUI, YOSHIICHI, 1930: Genetical Studies of Freshwater Fish 1. On the new Mutants in Carp *Cyprinus carpio* L. Suisan Shikenjo Hôkoku, 1 (1), pp. 166-176, pl. 15. (in Japanese).

In 1922, the author obtained white carp with pink eyes in both sexes and made genetical experiments by mating these albinos.

MATSUI, YOSHIICHI, 1930: The Races and Phylogeny of Goldfish. Nihon Gakuzitsu Kyôkai Hôkoku, Vol. 6, pp. 501-511. (in Japanese).

The many characters of goldfish, as shown in body form, nature of scale, color, head, eye, dorsal fin, caudal fin, anal fin, operculum, may be an interesting and important charactaristic for the phylogeny of goldfish. We have distinguished about 17 races in Japan. 1. "Wakin", 2. "Ryûkin" ("Ryûkin Shishigashira"), 3. "Ranchû" ("Osaka Ranchû", "Ranchu", "Nankin"), 4. "Demekin" ("Akademe-

kin", "Kurodemekin", "Sansyokudemekin, "Chôtengan" = introduced from China into Japan in 1897), 5. "Jikin" (produced during 1460–1807), 6. "Orandashishigashira" (produced in 1840 at Koriyama, Yamato, by crossing ,'Ranchû" and "Ryûkin"), 7. "Tetsuonaga".

Following races are made out by the interbreeding of many species.

1). "Watonai" In 1884, interbreeds between "Wakin" and "Ryûkin" by MATSUBARA S.

2). "Shûkin" In 1897, KICHIGORO, AKIYAMA made this race by interbreeding "Ranchû" and "Oranda".

3). "Kinranshi" In 1902–1903, interbreeding of "Ryûkin" and "Ranchu"

4). "Shubunkin" In 1923 ?, K. AKIYAMA made this race and it was named by MATSUBARA in 1900

5). "Kyariko" K. AKIYAMA made this race and it was named by FRANKLIN BACKARD in 1912.

From these facts, the author has made an ideal phylogenical tree of the goldfish which is commonly used in every education.

MIYADI, DENZABURÔ, 1930: Notes on a New Cyprinoid Fishes, *Pseudorasbora pumila* sp. nov. from Sinai-mura, Prov. Rikuzen. Ann. Zool. Jap., 12 (2), pp. 445–448.

The author collected a new fish which is allied to *Pseudorasbora parva* at Sinai-mura, Prov. Rikuzen. This is somewhat different in the deeper body and less number of scales from the typical species *L. pumillus* of SCHLEGEL.

MIYADI, DENZABURÔ, 1930: Fishes of Kizaki Lake, Nagano Prefecture. Studies on the northern Alpine Lakes in Japan, published by AKAMARO, TANAKA. Appendix, pp. 626–630, Shinano Kyoiku Kai. (in Japanese).

The hitherto known species of fishes found in Kizaki-ko, Nagano Prefecture are listed under 9 families and 22 species, of which *Oncohrynchus nerka* (WALBAUM), *Hypomesus olidus* (PALLAS) and *Sarcocheilichthys variegatus* (TEMMINCK et SCHLEGEL) were introduced. The most interesting facts on the distribution of fishes in Kizaki Lake are found in *Salvelinus pluvius* which likes to live in a very cold water and also *Moroco steindachneri* which are adopted to current water, and never found in other lakes as the Nojiri Lake and the Suwa Lake. The other interesting facts concerned to the introduction of fishes is in the case of *Oncorhychus nerka.* This fish originated from Akan Lake, Hokkaidô, ascending from sea to a river which has a lake in upper region and spawning up there. The youngs spend in lakes 3 years and descend into the sea. This fish introduced into many lakes in Japan are decreasing in size and change their habits into land-locked.

MORI, YASUMASA, 1930: A Regenerative Experiment of Lateral Scale of Goldfish. Zool. Mag., 42 (503), pp. 348–349, (in Japanese), (this paper was read at the Annual Meeting of Zoological Society of Japan).

The author makes the experiments of the regeneratins of lateral scales and lateral organs by using a goldfish of one and a half year. In this experiment he ascertains the regeneration of the lateral line comes out earlier in the head region than in others.

MORI, YASUMASA, 1930: On the Transformation of Ordinary Scales into Lateral-line Scales in the Goldfish. Journ. Facul. Sci. Zoology,* sect., Vol. 2, pp. 185–194.

The author makes some xperiments in order to see what change takes place in a scale inserted into the portion of the lateral-line, from which one or two lateral line scales have been extricated (autsphoric transplantation) in the gold-fish.

He said that if a lateral line scale is pulled out and in its place a scale taken from outside the lateral line is inserted, and the transplanted scale becomes a lateral-line scale acquiring all the organs of lateral line, i.e., a bony sheath, a sense organ in the lumen, a nerve regenerated from the torn stump of a branch of the lateral nerve, blood vessels, a pore pierced on the scale, etc.

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* Journ. Facul. Sci. = Journal of the Faculty of Science, Tôkyô Imperial University, published by the Faculty of Science Imperial University, Tôkyô.

Usually the formation of organs of lateral line on the transplanted scale begins immediately beneath the pore of the antecedent scale and gradually proceeds towards the posterior margin of the scale. As a rule if the more cephalad a scale from outside the lateral line is transplanted in place of a lateral-line scale, the faster it acquires the organs of lateral line. As regards the time required for the formation of organs of lateral-line there is no differnce between auto- and homoio-transplantion.

SCHMIDT, P. and LINDBERG, G., 1930: A List of Fishes, collected in Tsuruga (Japan) by W. Roszkowski. Bull. Acad. Scie. Ussr. pp. 1135–1150.

The writers study the large collection (84 spp. belonging to 48 families) of W. Roszkowski, assistant of Zoological Museum of Academy of Sciences of the USSR.

From the large collection including 84 spp., here 3 freshwater fishes are described as follows.

Plecoglossus altivelis, T. et SCH., Tsuruga. *Acahara hakonensis* (GÜNTHER), Tsuruga.
Mugil cephalus L.

YAMAMOTO, TOKI-O, 1930?: Studies on the Rhythmical Movements of the Early Embryo of *Oryzias latipes* II. Relation between Temperature and the Frequency of the Rhythmical Contractions. Journ. Facul. Sci. Zoology, sect. Vol. 2.

The author treats the relation between temperature and the rhythmical contractions found in the early embryos of *Oryzias latipes*. The movements of the embryo take place in ordinary tap water. But its consitution not being constant, 1/100 HERBST's artificial seawater with trace of $NaHCO_3$ as buffer was used throught the experiments. Eggs laid in the medium had been kept at 25°–27°C before they were subjected to various temperature. He concludes as follows: Relation between temperature and the frequency of the rhythmical movements which are exhibited by the early embryoof *Oryzias latipes* has been studied in a range of temperature from 7° to 39°C. It was found that the frequency is an exponential function of temperature according to the ARRHENIUS equation. The frequency increases regularly with temperatures with two critical temperatures at 15°C and at 29°C. The temperature constant $A=\frac{M}{2}$ for the upper temperatures is $5.0\times10^3-5.5\times10^3$, for the intemediate temperature $10.5\times10^3-11.0\times10^3$ and for the lower temperature $13.5\times10^3-14.5\times10^3$. The temperature constants for the rhythmical contraction in the early embryos of *Oryzias latipes* unquestionably differ from those vital ativities known to be associated with oxidative processes such as the heart beats of vertebrates. On the contrary these temperature constants agree well with those heretofore obtained for the rate of development or growth phenomena.

1931

EBINA, KENICHI, 1931; The Pearl Organs occurred on the Female of *Plecoglossus altivelis*. Journ. Imp. Fish. Inst. 26 (1), pp. 17–19. (in Japanese).

The author has discovered the pearl organs on the six specimens of females collected at the Tama River, Kanagawa Prefecture, on November 18, 1927. According to his descriptions, the pearl organs appear on both sexes during breeding season. In the female, they occurred on the chin, the dorsal side of trunk, the caudal peduncle, and the lateral side from the anal fin to ventral fin. They also found on the dorsal, anal and caudal fins but not on the adipose fin.

EBINA, KENICHI, 1931: Figures and Descriptions of Important Edible Fishes in Japan. pp. 1–180, pls. 1–180, with Classification Table and Index. Rakusuikai, Tôkyô. (in Japanese).

The author published the illustrations of Japanese fishes by help of Dr. K. MATSUBARA, Kyôto University, contained 180 species. These figures are selected among the 200 figures drawn by Mr. K. ITÔ and the original specimens are preserved in the Fisheries Institute, Tôkyô.

KAMOHARA, NENJI, 1931: Fishes from the Vicinity of Kôchi City. Zool. Mag., 43 (508), pp. 79–95. (in Japanese).

The author notes on the fishes from the vicinity of Kôchi City. From his notes, here we take out freshwater fishes only as follows.

Petromyzonidae:
1. *Entosphenus mitsukurii* (HATTA). (Motoyama Machi, Nagaoka-gun).

Salmonidae:
2. *Oncorhynchus macrostoma* (GÜNTHER.)
3. *Plecoglossus altivelis* T. et SCH.

Argentinidae:
4. *Argentina kagoshimae* JORDAN et SNYDER.

Siluridae:
5. *Parasilurus asotus* (LINN.).
6. *Fluvidraco nudiceps* (SAUVAGE).

Cobitidae:
7. *Misgurnus anguillicaudatus* (CANTOR).
8. *Cobitis biwae* JORDAN et SNYDER.

Cyprinidae:
9. *Pseudogobio esocinus* (T. et SCH.). Motoyama-chô
10. *Pseudorasbora parva* (T. et SCH.). Miwamura, Nagaoka-gun; Godaisan-mura
11. *Leuciscus hakonensis* GÜNTHER.
12. *Leuciscus jouyi* JORDAN et SNYDER. Ikewamachi.
13. *Zacco platypus* (T. et SCH.). Motoyamamachi.
14. *Zacco temmincki* (T. et SCH.)
15. *Carassius auratus* (LINN.).
16. *Cyprinus carpio* LINN.

Anguillidae:
17. *Anguilla japonica* T. et SCH.

Poeciliidae:
18. *Oryzias latipes* (T. et SCH.).

Hemirhamphidae:
19. *Hyporhamphus sajori* (T. et SCH.).

Mugilidae:
20. *Mugil cephalus* LINNAEUS.

Gobiidae:
21. *Acanthogobius flavimanus* (T. et SCH.).
22. *Tridentiger obscurus* (T. et SCH.).
23. *Leucopsarion petersi* HILGENDORF.

KAMOHARA, NENJI, 1931: Further Notes of Fishes in the Vicinity of Kôchi City (1). Zool. Mag., 43 (514), pp. 533–544. (in Japanese).

The author has added 220 species to the list of Kôchi fish fauna through his investigation. 13 species of freshwater fishes are also appended including the artificially introduced fishes *Salmo irideus* for food and *Gambusia affinis* for *Malaria* prevention.

KAWABATA, JÛGORÔ, 1931: Fishes and Shells found in Biwa Lake. pp. 1–198, pls. 1–12, map. 1–2. Tôkyo. (in Japanese).

This books was the memorial number of Mr. KAWABATA, JÛGORÔ who was previously the director of the Fisheries Experiment Station of Shiga Prefecture. He was one of the expert of freshwater fisheries and studying long time on the fisheries of Biwa Lake, Shiga Prefecture since 1883. He has described many fishes of Lake Biwa, concerning to spawning habit, food, fisheries, fishing ground and many other fields. He has also treated freshwater shells found in Biwa Lake.

KOBAYASHI, SHINJIRÔ, 1931: On the So-called "Cleaning Reflex" in *Carassius auratus* (L.), Iron Fish and Goldfish. Sci. Rep. Tôhoku Univ., Ser. 4, 6 (3), pp. 533–543.

In the group of fish, the clearing reflex is produced by the automatic excitement in the respiratory canter as well as in the respiratory movement, and that the automatic excitement of the clearing reflex is independent of the respiratory movement itself. The writer wishes to decide whether or not the form of the clearing reflex is specific to any given species or to the varieties and he undertakes to compare the clearing reflex in the supposedly related forms; *Carassius auratus* (L.), or "Silver carp", Iron fish and Goldfish. He found that these groups exhibit the type of clearing reflex characteristic to each, that is "silver carp type", "iron fish type" and "goldfish type". The greatest percentage of fishes in all the four groups is exhibited in "silver carp type" and I have discussed its biological significance and suggested that all these four groups may be genetically intimately related to one another. The different types of the clearing reflex are accomplished from the difference in the movements of the operculum and the opercular membrane.

KURODA, NAGAMICHI, 1931: A Catalogue of the Fishes of Shizuura, Suruga, Japan. Amoeba, vol.

3, no. 1–2, pp. 85–127. (in Japanese).

He has listed 325 species from Suruga, Shizuura, Shizuoka Prefecture. From this list, we find the following freshwater fishes. *Parasilurus asotus*, *Misgurnus anguillicaudatus*, *Leuciscus hakuensis*, *Cyprinus carpio*, *Carassius auratus*.

MATSUI, YOSHIICHI, 1931: Introducing of Goldfish in Japan. Suisan Ken-kyûshi, 26 (4), pp, 88–91. (in Japanese).

It is said that the goldfish was introduced in 1501 into Sakai, Senshû (Ôsaka-fu). The name of goldfish "Kingyo" in Japanese, originated during 923–930 of *Enchô* Era when the DAIGO Emperor ordered to MINAMOTO JUN ASON to select the name to give for this fish. In 1621, (17th year, *Keichô* Era) DÔSHUN, HAYASHI called it "Koganeuwo" in Japanese. The author described many other historial considerations on goldfish introduction and races.

MATSUI, YOSHIICHI, 1931: Genetical Studies of the Freshwater Fishes and Improvement of the Races. 2nd Report. Interbreeding of Carp and *Carassius*. Suisan Shikenjo Hôkoku, 2, pp. 129–137, pls. 15–16. (in Japanese).

He has declared that the hybrid between *Carassius auratus* and *Cyprinus carpio* has good taste, similar to *Carassius*, and more rapid growth than *Carassius*. It is profitable for fish culture. But the male is apt to be sterile as is the hybrid between goldfish and carp. This sterilization may be based on the abnormal condition of spermatogenesis.

NAKAGAWA, SUEYOSHI, 1931: Freshwater Fishes of Yamanashi Prefecture. (in Japanese, own prints).

The writer studies the freshwater fishes of Yamanashi Prefecture and reports as follows.

1. *Parasilurus asotus* (L.).
2. *Pseudogobio aurantiacus* (T. et SCH.).
3. *Liobagrus reini* HILGEN.
4. *Pseudobagrus nudiceps* (T. et SCH.).
5. *Misgurnus anguillicaudatus* (C.).
6. *Cobitis biwae* (JORD. et FOWL.).
7. *Lefua echigonia* JOR. et RICH.
8. *Plecoglossus altivelis* T. et SCH.
9. *Oncorhynchus macrostoma* (B.)
10. *Salvelinus pluvius* (H.)
11. *Salmo irideus* GIBBONS
12. *Salvelinus fontinalis* (MITEHIL).
13. *Hypomesus olidus* (P.).
14. *Salangichthys microdon* B.
15. *Cyprinus carpio* (L).
16. *Hemibarbus barbus* (SCH)
17. *Carassius auratus* (L.)
18. *Gnathopogon elong. elongatus* (SCH.).
19. *Acheilognathus* sp.
20. *Tribolodon hakuensis* (G.)
21. *Phoxinus steindachneri* SAUVAGE.
22. *Zacco platypus* (T. et SCH.).
23. *Zacco temmimcki* (T. et SCH.).
24. *Moroco steindachneri* (SAUVAGE).
25. *Pseudorasbora parva* (SCHL.).
26. Colored *Cyprinus carpio* LINN.
27. *Acheilognathus moriokae* JORD. et THOMP.
28. *Acheilognathus lanceolata* (T. et SCH).
29. *Pseudoperilampus typus* BLEEKER.
30. *Pseudogobio esocinus* (T. et SCH.).
31. *Anguilla japonica* T. et SCH.
32. *Aplocheilus latipes* (T. et SCH.)
33. *Pygosteus sinensis* (G.)
34. *Gasterosteus aculeatus aculeatus* (L.)
35. *Lateolabrax japonicus* (CUV. et VALLEN.)
36. *Mugil cephalus* (L.)
37. *Cottus pollux* GUTH.
38. *Cottus kajika* J. et. S.
39. *Gobius* sp.
40. *Gobius similis* (GILL).
41. *Tridentiger obscurus obscurus* (SCH.).
42. *Mogurnda obscura* (T. et SCH.).

OKA, TOHRU, B. 1931: On the Processes on the Fin-rays of the Male of *Oryzias latipes* and other Sex Characters of this Fish. Journ. Faculty Sci. Zoology, Sect. vol. 2, pp. 209–218.

The author discovered a new sexual characters of *Oryzias latipes* on the anal fin. The male anal fin takes the shape of a parallel organ and its posterior and reaches as the base of the caudal fin. In the male, the fin rays rarely branch dichotomously. In the female, on the contrary, all the fin-rays are bifurcated dichotomously at their distal ends. Finger-like processes on the fin-rays hardly seen in the

male. These processes appear only in the adult and are found on every joint of the 6 rays; from the second to the seventh counting from the posterior end. The first ray is short, separated from the rest, and has a rule on the processes, though very seldom it is provided with them. In old fishes the eighth also has the rudimentary processes.

OKA, TOHRU, B. 1931: On the Accidental Hermaphroditism in *Oryzias latipes*. Journ. Fac. Sci. Zoology, ser. Vol. 2, pp. 219-223.

The writer discovered pseudo-ocytes found in the testes of the 3 specimens of *Oryzias latipes*. He has not found true oocytes in testes. He found that the pseud-oocytes were found only in one of the two testes. The nucleus of pseudo-ocyte at the pachytene stage is smaller than that of the true oocytes of the same stage. A single nucleolus of the pseud-oocytes remains until later stages, while in the true oocytes it is replaced by scattered nucleoli at an early stage. In the pseud-oocytes pallial substance is much less prominent than that of the true oocytes of the same size. The pseud-oocytes and the sperm cells are derived from a primary spermatogonial cell, both being found in the same cyst. No chromosomes show heterosycinosis in this species.

TANAKA, SHIGEHO, 1931: On the Distribution of Fishes in Japanese Waters. Jour. Fac. Sci. Imp. Univ. Tôkyo, Sec. IV, 3 (1), pp. 1-90.

The author describes some examples of the variation in fishes, faunal areas of fishes of Japan, lists of the fishes in their respective faunal areas. From his paper, here we discuss the distribution of freshwater fishes only. He says that Japan is divisible into three areas from the viewpoint of the freshwater fish fauna; namely Southern Japan, Northern Hondô and Hokkaidô. Southern Japan area corresponds well with that of the marine fishes, except the Tama River flowing into the Bay of Tôkyô, which seems to belong to Northern Hondô area.

Its northern limit on Japan Sea coast is rather vague as shown in the case of the marine fish. Northern Hondô and Hokkaidô areas taken together correspond to the northern Japan of the marine fishes, the boundary between the both being chiefly the Strait of Tsugaru which is known well as BLACKISTON's Line by the students of Japanese ornithology and mammalogy, a few species of Northern Hondô area extending their range to southern portion of Hokkaidô. Freshwater fishes belonging to Southern Japan may range in some cases to India, while northern forms, especially Hokkaidô ones, may range to Saghalien and even Siberia. Here, the writer seems to have considered the Japanese Fishes to have a limited distribution. Some freshwater fishes, such as *Hymenophyas curta* (T. et SCH.), *Opsariichthys uncirostris* (T. et SCH.) *Sarcocheilichthys variegatus* (T. et SCH.), *Biwa zezera* (ISHIKAWA) are, for examples, ranging to Korea and China. Some of other fishes, *Pseudobagrus aurantiacus* (T. et SCH.) and *Abbottina psegma* JORDAN et FOWLER are distributed in discontinuous ways in Japan.

1. List of the freshwater fishes in Southern Japan area.
   Pelteobagrus nudiceps (SAUVAGE).
   Pungtungia hilgendorfi (ISHIKAWA).
   Oryzias latipes (T. et SCH.).
   Mogurnda obscura (T. et SCH.).
   Rhinogobius giurinus RUTTER.
   Hemigrammocypris rasborella FOWLER.
   Fluta alba (ZUIEUN).
   Bryttosus kawamebari (T. et SCH.).
   Eleotris oxycephala (T. et SCH.).
   Sicyopterus japonicus (TANAKA).
2. List of the freshwater fishes occurring in the Northern Hondô area.
   Lefua echigonia JORDAN et RICHARDSON.
   Chloea nakamurae J. et RICH.
   Pseudoperilampus typus BLEEKER.
3. List of the freshwater fishes occurring in Hokkaidô area.
   Hucho perryi BREVOORT.
   Barbatula oreas (J. et F.).
   Lefua nikkonis (JORDAN et FOWLER).

3. List of the freshwater fishes occurring both in Southern Japan and Northern Hondô areas.
   Parasilurus asotus (L.).
   Misgurnus fossilis (L.).
   Cobitis anguillicaudatus. CANTOR.
   Acheilognathus lanceolata (T. et SCH.).
   Liobgarus reini HILGENDORF.
   Cobitis taenia LINN.
   Cob. biwae J. et S.

Cap. intermedia, Cap. limbata, Cap. rhombeus, Ach. mesembrinun, Ach. cyanostigma, Ach. longipinnus, Rhodeus oryzae, Ach. shimazui, Ach. smithi, Rhodeus miobuta, Rh. tanago, Ach. brevianalis, Ach. tabira, Ach. moriokae, Ach. atrenius, Acanthorhodeus sciosemus, Rho. kurumeus.

Gnathopogon elongatus (T. et SCH.)

Capoeta gracilis, Squalius, Sq. japonicus, Gobio biwae, G. mayedae, Otakia rasborina, Leucogobio güntheri, L. jordani, Gnathopogon ishikawae.

Hemibarbus barbus barbus (T. et SCH.).

Pseudogobio esoinus (T. et SCH.).

Pseudorasbora parva (T. et SCH.).

Fundlichthys virescens T. et SCH., *Pseudorasbora pumila miyadi*

Zacco platypus (T. et SCH.).

Cyprinus carpio LINN.

Zacco evotans J. et EV.

Cottus kazika

Cottus reini, C. dybowskii, Rheopresbe fujiyamae J. et STAR.

Rhinogobius similis GILL.

G. yokohamae, Rhinogobius, Ctengobius bedfordi REGAN, *Ct. candidius* REGAN, *Ct. kurodae* TANAKA, *Ct. katonis* TANAKA, *Rhinogobius taiwanus* OSHIMA, *Rh. fluviatilis* TANAKA.

Chaenogobius macrognathus (BLEEKER).

Chaenogobius isaza TANAKA.

5. List of the Freshwater fishes occurring both in Hokkaidô and Northern Hondô areas.

1. *Pygosteus pungitius* (L.).

Gasterosteus GIUCHENOT, *G. tymensis* NIKOLSKY, *Pygosteus brevispinosus* OTAKI, *Pygosteus kaibarae* TANAKA.

6. List of the Freshwater Fishes ranging throughout Japan.

Lampetra planeri (BLOCH).

Leuciscus hakonensis GÜNTHER

L. taczanowskii STEIND., *L. phalacrocorax* J. et F. *Phoxinus septentrionalis* J. et SEALE, *Acahara jusanensis* J. et HUBBS.

Carassius carassius (L.).

Cyprinus auratus L.

7. List of the freshwater fishes with a very limited distribution range in Japan.

Pseudobagrus aurantiacus,

Hymenophysa curta,

Ischikauia steenackeri,

Sarcocheilichthys steenackeri

S. wakiyae MORI, *S. kobayashii* MORI, *S. koreensis* MORI.

Abbottina psegma JORDAN et FOWLER.

Biwia zezera (ISHIKAWA).

Opsariichthys uncirostris (T. et SCH.).

Op. bidens GUNTHER.

Trachidermis fasciatus HECKEL.

8. List of fishes living in freshwaters as in sea.

Hypomesus olidus, Tridentiger obscurus, Luciogobius guttatus.

TANAKA, SHIGEHO, 1931: Notes on Salmon and Trout. Zool. Mag., 43(507), pp. 7-12. (in Japanese).

He believed that the Japanese trout would be the same to the silver salmon of Western America and found many forms in Japan. The interbreeding of salmon and trout has been carried out in the natural conditions of Japan. The scientific name of this species may be *Salmo kisutsch.*

TANAKA, SHIGEHO, 1931: Notes on Fishes of Japan. Zool. Mag., 43(507), pp. 23-33. (in Japanese).

He notes on the fishes collected in Lake Suwa.

1. *Liobagrus reinii*
2. *Parasilurus latipes.*
3. *Misgurnus anguillicaudatus.*
4. *Cobitis biwae.*
5. *Cyprinus carpio.*
6. *Carasius auratus.*
7. *Gnathopogon sp.*
8. *Pseudogobio esocinus*
9. *Zacco platypus.*
10. *Zacco temmincki.*
11. *Tribolodon hakuensis.*
12. *Anguilla japonica.*
13. *Oncorhynchus masou.*
14. *Moroco steindachneri.*
15. *Aplocheilus latipes.*

Transplanted fish.

1. *Sarcocheilichthys variegatus.* In 1913, it was introduced from Lake Biwa.
2. *Hypomesus olidus.* In 1914, it was introduced from Kasumiga-ura.
3. *Entosphenus mitsukurii* (HATTA). It might have been introduced from other districts.
4. *Acheilognathus moriokae.* It was introduced from Kasumiga-ura together with *Anodonta.*

YAMAMOTO, TOKI-O, 1931: Studies on the Rhythmical Movements of the Early Embryos of *Oryzias latipes.* I. General Description. Jour. Fac. Sci. Imp. Univ. Tôkyo, 2 (3), pp. 147–152.

The writer finds out the curious rhythmical movements during his study on the development of the eggs of *Oryzias latipes* in the summer of 1928. He shows in this report a general description of the rhythmical contractions of this fish.

YAMAMOTO, TOKI-O, 1931: Temperature Constants for the Rate of Heart Beats in *Oryzias latipes.* Jour. Fac. Sci., Ser. Zoology, vol. 2, pp. 381–388.

The rate of heart beats of the 4 and 8 day embryos at 25°C, embryos shortly before hatching, and the isolated and intact hearts of adults of *Oryzias latipes* have been studied over a wide range of temperature and the constants $A\left(=\frac{\mu}{2}\right)$ in the ARRHENIUS equation have been calculaed. The temperature constants $A\left(=\frac{\mu}{2}\right)$ for 4 and 8 day embryos, for the embryos shortly before hatching and for the isolated hearts of adults corresponds well with those previously obtained for the cardiac rhythms of vertebrates and respiratory processes A for lower ranges of temperature in the intact hearts of adults are $8.0\times10^3-8.3\times10^3$ which are similar to those previously obtained for the processes above mentioned temperature constants for higher ranges of temperature are $1.2\times10^3-6.3\times10^3$ which are identical with those obtained for heart-beats of *Limulus*, *Ceriodaphnia* and *Bomybyx* which are considered to be neurogenic. These facts are in harmoney with the theory that the heart beat of vertebrates which in its origin is myogenic may partly be modified by the nevous influence. Temperature constants for heart-beats of *Oryzias latipes* are decidedly different from those obtained for the peculiar rhythmical movements found in the early embryos of this form.

YAMAMOTO, TOKI-O, 1931: Studies on the Rhythmical Movements of the Early Embryo of *Oryzias latipes.* II. Relation between Temperature and the Frequency of the Rhythmical Contractions. Jour. Fac. Sci. Imp. Univ. Tôkyo, 2 (3), pp. 153–162.

The writer studies on the relation between temperature and the rhythmical contractions found in the early embryos of *Oryzias latipes.* He concludes that this experiment shall be carried out in a range of temperature from 7° to 39°C. The frequency is an exponential function of temperature according to the ARRHENIUS equation. The frequency increases regularly with temperature with two critical temperatures at 15°C and at 29°C. The temperature constant $A=\frac{\mu}{2}$ for the upper temperature is $5.0\times10^3-5.5\times10^3$, for the lower temperature $13.5\times10^3-14.5\times10^3$. The temperature constants for the rhythmical contraction in the early embryos of *Oryzias latipes* unquestionably differ from those vital activties known to be associated with oxidative processes such as the heart beats of vertebrates. On the contrary these temperature constants agree well with those heretofore obtained for the rate of development or growth phenomena.

1932

HATAI, SHINKISHI and ABE, NOBORU, 1932: The Responses of the Catfish, *Parasilurus asotus* to Earthquakes. Proc. Imp. Acad., 8 (8), pp. 375–378.

The authors describe the responses of Catfish in this paper. It is found to respond in a definite manner in advance of the occurrence of an earthquake. They conclude from their experiments that this

fish becomes sensitive to a knocking sound 6-8 hours before an earthquake is recorded. What sort of disturbance the catfish feels previous to an earthquake is not yet certain. The ultra-sensitivity of the catfish to sound as well as to electrical stimuli, leads us to suspect the variation of the each current as well as some peculiar vibration preliminary to the final occurrence of an earthquake as the sources of the stimuli.

HONDA, KIYOSHI, 1932: Notes on the Color Phase of Carp produced in Echigo Province. Suisan-gaku Zasshi, (35), pp. 278-284. (in Japanese).

The author mentioned a very famous color phase of carp produced in Echigo Province, Niigata Prefecture 150 years ago. The history is not accurate, but according to a tradition, the ancestor originated through the interbreeding between red and white color carps around the beginning of 17 centuries, in a pond of a shrine located at Higashiyama and Hhigashizawa villages, Echigo Province. During the 7th and 8th years of Meiji Era, the breeders increased more in number, making the improvement of various color phases, as red and white, greenish yellow, light yellow and exported to Hida, Echû, Echizen, and Shinano Provinces. The chief producing district is located in Nijusongô village, Nigata Prefecture. The color phases are quite variable and are distinguished into 17 phases, as Kohaku, Sanke, Taishosake, Showa-sanke, Shiroutsuri, Kinborai, Asagi, Bekko, Kiutsuri, Higoi, Shiromuji, Ginbo, Agin, Kinkoi, Bakemono, Kinrui and Kinzakura. The object of selection of of color phase is chiefly dealt with the finess of colors and patterns. Primarily selection is carried out on the end of June for the youngs measured about 3 cm. in body length. Secondarily section is made for the youngs measured 6-9 cm., about 60 bays after hatching out. Third selection is made for the youngs which exhibit special colors and patterns. On the middle of November, the selection may be made again for the superior phases to hibernate during winter and to sell. The feeding method not differs from that of ordinal carp. In this village, they are rearing in a reservoir and paddy field. As this district has a deep snow they have a special pond for superior phases to keep during winter. The parent adult fish are mostly selected by the ages and beautiful colors as well as special patterns. The proper ages for female 5 to 12 years and for male 3-12 years. The price is raised higher after the war. They are sold Ôsaka, Kanazawa, Toyama, Gifu, Nagano, Yamagata, Akita, Fukushima, and Tôkyô as pond fish. Recently some of them are exported to United States.

IKEDA, KAHEI, 1932: Notes on the Castration of *Gasterosteus cataphractus*. Zool. Mag., 44 (519-520), pp. 36-37. (in Japanese).

This paper is a preliminary report of the castration of *Gasterosteus*. The complete paper was published in Japanese Journal of Zoology, V, 2, pp. 135-157. The author changes the specific name of *G. cataphractus* into *Gast. aculeatus aculeatus* (L.) in the latter paper.

KATOH, GENJI, 1932: On the Sex Ratio and the Growth of Body in *Carassius auratus* and its Variety "The Ironfish". Sci. Rep. Tohoku Imp. Univ., ser. 4, 7 (3), pp. 365-380.

The author makes experiments on the sex ratio and the body growth of *Carassius* and its variety. The sexual differentiation of gonad in *Carassius auratus* becomes distinct about two months after the hatching while that in the iron fish occurs one month earlier. The sex ratio of the iron fish contrary to that of *Carassius auratus* is almost one to one. The result of this experiment is that the iron fish resembles more the gold fish. The pH of water influence is striking to both the eggs and young fishes of *Carassius* and iron fish. Generally, acid is more injurious than alkali. In the iron fish, the annual mean growth is very rapid in the first year and fom the next year on the growth rate is gradually diminished. In *Carassius*, the ratio between body length and width is variable, and has a higher value in the fish living in pond than those living in the river.

KAWAMOTO, NOBUYUKI, 1932: Notes on the total Convulsions of Eel. Zool. Mag. 44 (523), pp. 199-200. (in Japanese).

The phenomenon of convulsions is known to occur quite often in such warm blooded animals as

man, dog and pigeons but it rarely occurs in cold-blooded animals. This physiological phenomenon occurs rarely in *Bufo vulgaris* when difficult in Vitamin B. The author has observed the convulsions in eels in the course of starvation experiments. Sudden approaching of man and the sound or closing of the fishing net caused the eels to suddenly escape from them and in that instance the convulsion of the entire body appeared. If the convulsion occurs several times, they will die in a few months. Whether this phenomenon is due to starvation or the lack of Vitamin B. is not yet resolved.

KAWAMOTO, NOBUYUKI, 1932-1933: Physiology of Fishes. Rakusui Kaisshi, Sep., 1932 to July 1933, pp. 890-994, 1083-1089, 1176-1186, 61-66, 129-135, 234-240, 310-321, 443-451, 539-546. (in Japanese).

The author described the general aspects of the respiratory and sensory physiology of fishes.

KOBAYASHI, JUNICHIRÔ, 1932: General Observation of Japanese Gasterostiid Fishes. Sc. Hiroshima Univ., Ser. B, Div. 1, Vol. 1, Zoology, 1(5-9), 8, pp. 145-154.

The author studied the systematic arrangement of 6 species and subspecies of Japanese Gasterosteid Fishes. The author recognizes spp. *Gasterosteus aculeatus aculeatus* (GIRARD), *G. aculeatus microcephalus* (GIRARD), *Pungitius brevispinosus* (OTAKI), *Pungitius* var. *tymensis* (NIKOLSKY), *Pungitius sinensis* (GUICHENOT), *Pungitius kaibarae* (TANAKA) these species are quite different from the general ecology. He has made also ecological sketches on the seasonal migration and spawning habits, on their nests, color in sexual sason and habitats.

MATSUI, YOSHIICHI, 1932: The Secondary Sexual Characters and the Sterilities of Carp, Crucian Carp, Goldfish and Interbreeders. Nihongakujitsu Kyokai Hôkoku, 7 (2), pp. 118-126. (in Japanese).

The pearl organ appears on the whole body of carp and also lines along the margin of scale. It appears in the breeding season whereas also in the female interbreeders of Japanese and German carp. In Goldfish, the organ, without any relationship with the age, appears in abundant in a definite situation, and caudal fin and scales. In few females, the pearl organ appears on opercle and pectoral fin. The lst interbreeds of carp and cruscian carp or a carp and goldfish were sterile. They may be called a bigeneric hybrid.

SUZUKI, NAOKICHI, 1932: The Saccus Vasculosus of Mid-brain of Salmonidae. Zool. Mag., 44 (519-520), p. 7. (in Japanese).

The writer reports that the Saccus vasculosus of the base of Mid-brain is a special part of the aquatic animals. In most of the fishes, it is quite changeable. The writer observed this organ in Japanese Salmonidae morphologically. Of this group, in *Plecoglossus altivelis*, *Salvelinus pluvius*, *Oncorhynchus macrostomus*, this part well developed, in *Oncorhynchus masou*, the middle and *Oncorhynchus keta*, *Salmo irideus*, *Salmo alpinus* in the least.

TANAKA, SHIGEHO, 1932: Studies on the Samples of Fish. IX. Zool. Mag., 44 (525), pp. 295-300. (in Japanese).

Mr. IMANISHI, IWATARO, a teacher of Nara Prefectural Girls' High School of Gojô published a small book called "Studies of Fishes distributed in the River Yoshino, Nara Prefecture". The Yoshino is a large river running through the Province of Yamato from east to west. Here the author, Dr. Sh. TANAKA, picked up the freshwater fishes and some ecological aspects.

1. *Lampetra planeri*:
2. *Salvelinus malma*: This lives in the upper part of the River Yoshino, Nara Prefecture.

3. *Salmo milktschitch*: This has a red spot on each side of body.
4. *Plecoglossus altivelis*: This is proud of having light red color.
5. *Parasilurus asotus*: This fish is so carnivorous that we must take a close care of the fish culture pond of it, together with other small fishes.
6. *Pelteobagrus nudipes*: This fish is not found in Nara Prefecture. The body is yellowish brown and changes into yellow when dying. The color also changes to the environments.
7. *Liobagrus reini*: This fish spawns on the sandy place.
8. *Cobitis taenia*: This fish lives in muddy waters.
9. *Zezera hilgendorfi*: This fish is abundant; in winter, the color of fish is deep when it is caught during water and the black lateral striature rather indistinct. It gathers in a cave when the water comes.
10. *Pseudorasbora parva*: This fish has eggs during March and April.
11. *Gnathopogon elongata*: In general, the young fishes are called "Moroko"; the taste is good in winter.
12. *Zacco temmincki*: This fish is always distributed in a branch of the River Yoshinogawa.
13. *Acheilognathus tabira*:
14. *Ach. limbata*:
15. *Ach. cyanostigma*:
16. *Ach. intermedia*:
17. *Hemibarbus barbus*: This fish is decreasing in this river. The colour is brownish silver on the back and whitish silver on the belly when it is fresh.
18. *Leuciscus jouryi*: Specimens with yellow-golden patterns on the back or no?.
19. *Belligobio eristigma*: This is rather abundant in the River Yoshino, living in the sandy bottom. In winter, it lives in warmer spring waters.
20. *Zacco platypus*: This fish is most abundant. The nuptial color in the breeding season is very beautiful. The spawning occurs during June, July and August. The spawning place is a shallow, sandy bottom.
21. *Pseudogobio esocinus*: It is rather abundant, likes to live in sandy waters and in winter it barries into the mud.
22. *Leuciscus hakonensis*: The nuptial color appears on the male. In the River Yoshino, the spawning season occurs in April.
23. *Cyprinus carpio*: The carp which lives in the River Yoshino is somewhat different in its outer configuration.
24. *Carassius carassius*: Natural crusian carp is morp aboundant. During the rainy season, when the water becomes dark, the cruscian carp is caught with a net which is called "Nigori carp".
25. *Anguilla japonica*: The eel is called by different names, "Hosoguchi" and "Kaguraguch" by the outher configuration.
26. *Cottus pollux*: It lives in color waters and sandy botton. From October on, it descends the river and in April it ascends to a river.
27. *Odontobutis obscura*: The color is light brown, and changeable by the environment. The fish likes to live in cooler waters and keeps it easy in a pond.
28. *Rhinogobius obscurus*: It lives in a branch or the main stream of the River Yoshino, hiding between small pebbles. The body is brown or green brown color.
29. *Tridentiger opscurus*: It sucks on the stones.
30. *Sicyopterus japonicus*: The sucking power is very strong even in the current waters.

TANAKA, SHIGEHO, 1932: Studies on the Samples of Fish. X. Zool. Mag., 44 (526), pp. 332–333. (in Japanese).

A teacher Mr. SUEYOSHI, NAKAGAWA, Yamanashi Prefecture, Minobu Middle Shool, collected many specimens in this Prefecture and listed. Dr. SH. TANAKA offers a short note here in this magazine.

1. *Parasilusus asotus*.
2. *Pseudobagrus aurantiacus*.

3. *Liobagrus reini.*
4. *Misgurnus fossilis.*
5. *Cobitis taenia.*
6. *Lefua echigonia.*
7. *Plecoglossus altivelis.*
8. *Salmo milktschtch.*
9. *Salmo nerka.*
10. *Salvelinus malma.*
11. *Hypomesus olidus.*
12. *Cyprinus carpio.*
13. *Hemibarbus barbus.*
14. *Carassius carassius.*
15. *Gnathopogon elongatus.*
16. *Acheilognathus lanceolata.*
17. *Leuciscus hakonensis.*
18. *Leuciscus jouyi.*
19. *Zacco platypus.*
20. *Sarcocheilichthys variegatus.*
21. *Pseudogobio esocinus.*
22. *Anguilla japonica.*
23. *Oryzias latipes.*
24. *Lateolabrax japonicus.*
25. *Mugil cephalus.*
26. *Cottus kazika.*
27. *Cottus pollux.*
28. *Rhinogobius similis.*
29. *Tridentiger obscurus.*
30. *Sicyopterus japonicus.*

UCHIDA, KEITARÔ, 1932: Pisces. Cyclostomata, Cephalochorda. pp. 1–115, Iwanami-Koza, Seibutsugaku. Iwanami, Tôkyô. (in Japanese).

This is one of the Biological series called Seibutsugaku, Iwanamikoza. The author is in charge of the fish part of this series. He mentioned the general aspects of this is three paragraphs. The first paragraph has the contents of the general discussion of classification, phylogy, and the next paragraph includes the general of Cyclostomata and the third paragraph includes Cepharocorda.

1933

ABE, KEI, 1933: *Plecoglossus altivelis.* Daissokai, Suisankai, Tôkyô, pp. 1–265. (in Japanese).

The author published a book titled with Ayu (*Plecoglossus altivelis*) in 1933. The contents included many facts concerned all about this fish. In the first paragraph, he described the general aspects of the configuration of the fish and the old historical records about the fish as well as the distribution and land locked and anadromous ones. In the second paragraph, he mentioned the artificial hatching scheme and in the third paragraph, about the transplantation of land-rocked fish is mentioned. In the fourth paragraph, he described sea and ascending youngs as seedlings for transplantation. In the fifth paragraph, he mentioned the transplanting scheme into the lake and reservoir and in the sixth paragraph, pond culture of the fish. In the seventh paragraph, the mixed feeding of carp, crucian carp, eel and dace with Ayu. In the eighth paragraph, he mentioned about the possibility of paddy field breeding and pond breeding. In the nineth paragraph, he made a consideration of the possibility of feeding of youngs after artificial fertilization in ponds. In the nineth paragraph, he noted a hibernating method of the adult fish by preventing the spawning. In the eleventh paragraph, he described a corpulent method after spawning. In the twelveth paragraph, he described the fish as one of the appreciative fish. In the thirteenth, and fourteenth paragraphs, he mentioned the cooking and manufacturing.

ASAKUMA, TAKUYA, 1933: On the Migration of "Karafuto Masu" (*Oncorhynchus gorbuscha* (WALBAUM). Yoshokukaishi,* 3 (5), pp. 77–82. (in Japanese).

The marking experiments for studying fish migration were carried out by the Fisheries Experiment Station of Hokkaidô during the years from 1928 to 1931. The result of the experiment in Hokkaidô is as follows: Migration route along the coast of Hokkaidô: From April to June, the fish school appears along the southeastern coast of Hokkaidô, within 10 days it reaches the Kurile Islands, then goes up to the Okhotsk Sea through the Yetorup Strait or Kunashiri Channel. 20 days later from the middle of June to the end of August, the school proceeds along the southern coast and eastern coast of Sagh-

* Yoshokukaishi = Bulletin of Pisciculture, published by the Pisciculture Society, attached to the Pisciculture Inistitute of the Fisheries College, Tôkyô.

alien and enters into the rivers for spawning. The school in the vicinity of Etorofu Island does not proceed northward mixing with the group of Yetorup Isl. The group in the Alaido Island of the northern Kuriles goes northward to the western coast of Kamtchakka for spawning. Migration route of the northern coast of Japan Sea: The fish school for migration off Zozan Bay of Kankyô Hokudô and Zyôshin in Korea, and proceed the Russian coast from the middle of May to the begining of June and upon reaching Dattan Kaiwan then migrate to the vicinity of Kokuryukô. After the shool passes through Mamiya Strait, it swims out into the sea of Okhotsk to the mouth of the Uria River on the Ohotsoski coast. The speed of mirgation: The Hokkaidô shool passing through the southern part of the Kurile Island to the Sea of Okhotsk and on to Saghalien swims an average of 27.4 km. a day. Namely one group migrates 750 miles distance in 43 days while the other group 68 miles in 4 days. The other school of the northern part of Sea of Japan proceeding from the northeastern coast of Korea to Dattan Bay through Mamiya Channel and on to Sea of Okhotsk swims 62 miles a day.

HOKKAIDÔ FISHERIES INSTITUTION, 1933: Research of Lakes in Hokkidô; Nenbetsuko, Lake Panke, Lake Penke, and Kabuto-numa. Suisan Chosa Hôkoku, Vol. 29, pp. 1–72. (in Japanese).

In Nenbetsuko, very few freshwater fishes *Salvelinus malma*, *Salvelinus fontinalis*, *Salmo irideus*, are found. *Salvelinus malma* is only a natural species and the other two species were introduced from other countries. Lake Panke is a brakish water and has many fishes than Lake Penke.

The species of Lake Panke are as follows. *Gasterosteus cataphlax*, *Triblodon hakuensis*, *Osmerus dentex*, *Acipenser mikaddoi*, *Salvelinus kundscha*.

IKEDA, KAHEI, 1933: Effect of Castration on the Secondary Sexual Characters of Anadromous Three-spined Stickleback, *Gasteroteus aculeatus aculeatus* (L.). Jap. Jour. Zool., V, 2, pp. 135–157.

The author performed these experiments on the specimens caught in Niigata Prefecture and the Agano River, Fukushima Pref., during 1931–1932. The present species spawn in early spring. The nests are built on the bottoms of streams or paddy fields from April to June. It apparently dies after spawning and all the young descend to the sea then they are 20–30 mm. in body length. Before the development of nupital coloration, both sexes may be distinguished by body length and weight, the relative length of the head with respect to the distance between the ventral spine and the anal fin and by the dorsal spines. Castration performed after partial development of nupital coloration inhibits the development of the erythrophores or hastens their disappearance. Nearly all castrated lose the instinct of identification. In the breeding season the male kidney becomes enlarged, and the epithelial cells of the renal tubules become swollen at their free ends and are filled with eosinophil secretory granules, which produce a glutinous nest-cementing substance. Complete castration causes sudden return of the kidney to the non-breeding condition while partial castration causes no retrogressive change.

IKEDA, KAHEI, 1933: The Distribution and Variation of *Gasterosteus* in Japan. Zool. Mag., 45 (534), pp. 141–173. (in Japanese).

The author has described the geographical distribution of five species of *Gasterosteus* and *Pungitius* and their variations. *Pungitius tymensis* (N.) is limited to Hokkaidô and the other 4 species are mostly found in northern Japan for north of 35° latitude. *Gasterosteus aculeatus aculeatus* (L.) has two forms, one is marine and the other is land locked. The variation of the lateral plate is not distinct in the marine form while it is rather distinct in the land locked form, decreasing in number from north to south. In the species of *Pungitius*, the shortening of the body and the decrease in the number of dorsal spines and lateral plates appears in the specimens from north to south, especially in *P. pungitius* very distinct while in *P. sinensis* it is not distinct.

INUKAI, TETSUO, 1933: A Study of Food Habit of *Salvelinus pluvius* HILGENDORF (Preliminary). Journ. Sapporo Soc. Agr. For., 24 (111), pp. 1–2. (in Japanese).

The writers make some observations on the natural food of *Salvelinus pluvius*. They got 230 adult

fishes at the River Ishikari during the beginning and the end of September. Most of the food is insect and arachnida. The insect is consisting of 10 orders, 29 families, the aquatic insects occupying about 3 times of the terrestrial ones. One individual took 12 spp. 33 individuals in August and 11 spp. 81 individuals in September. From this result, they suppose that this fish is quite omniborous and the food is mostly occupied by the insects belonging to Trichoptera.

KAMOHARA, NENJI, 1933: The Ripe Egg of Japanese Eel: Zool. Mag., 45 (531), p. 30. (in Japanese).

The author has described on of the largest eel eggs which measured 0.3 mm. in diameter. The eel from which the egg was taken was obtained at the upper branch of Kôzu River, about 3 miles from the Urato Bay at Kôchi. The body was 70 cm. in length, and the ovary was developed to the length of 15 cm. He proposes that such a mature eel may descend far to the deep sea bottom off the Phillipine Islands.

KINOSHITA, MORIYE, 1933: Freshwater Fishes of Yanakawa (the Yebe River). Fukuoka Prefecture, Yanakawa. Copies printed from Girl's High School, Fukuoka Prefecture. (in Japanese).

The author mentioned the following species from the Yanakawa, Fukuoka Prefecture: *Acheilognathus tabira*, *A. rhombeum*, *Zacco platypus*, *Acheilognathus intermedium*, *A. limbatus*, *A. moriokae*. *Rhodeus kurumeus*, *Carassius auratus*, *Pseudorasbora parva*, *Abbottina psegma*, *Pseudogobio esocinus*. *Sarcocheilichthys variegatus*, *Zacco temmincki*, *Acanthorhodeus atremius*. *Zezera hilgendorfi*, *Leuciscus jouyi*. *Cyprinus carpio*. *Gnathopogon gracilis*.

KINOSHITA, TOSHIYUKI, 1933: A New Case of Hermaphroditism in *Carassius auratus* (L.) Jour. Scie. Hiroshima Univ.,* 2 (12), pp. 205–210.

The writer finds out the hermaphroditic *Carassius auratus* at Hiroshima.

The specimen has the right gonad, the socalled "Ovacontaining testis", while the left is a normal one. The testis-ovum is, as a rule, smaller than the true oocyte, and is devoid of the follicular epithetium. The interstitial cell has plenty of cytoplasms, and the shape of a cell is usually irregularly polygonal under the pressure of the neighbouring cells.

KOBAYASHI, JUNICHIRÔ, 1933: Ecology of a Stickleback, *Pungitius sinensis* var. *kaibarae* (TANAKA). Journ. Sci. Hiroshima Univ., ser. B, Div. I, Zoology, 2 (5), pp. 1–89.

The author recorded his findings on the ecology of *Pungitius sinensis sinensis* var. *kaibarae* (TANAKA). These studies were made in the laboratory of Kyôto Imperial University and the habits on the southwestern outshirts of Kyôto, from November 1925 to February 1927, but the later investigations of the habitats and the supplemental studies have been going on in the laboratory of Hiroshima Normal College ever since.

The results are as follows: This fish formerly migrated for quite a distance between the breeding grounds and the feeding grounds and the deep water of the streams far away, but at present as the habitats have become quite restricted through the pollution by dirty water, the fish migrates only between the shallows and the deep water in the near brooks or paddy fields.

Except the females with the matured ova and larvae less than about 3 cm. long, this fish fights against his rivals by means of a peculiar method; viz., he heads himself ready to strike at the rivals rais ing all his spines, and bending his body in an S-shaped form or reverse S-shaped form opposite the latter, and then attacks them with his mouth and ventral spines; but beside the struggling of the males in the spawning period, their warfare is not so desperate nor so persistent.

The spines of this fish begin to form themselves when the fry has reached about 1 cm. in total length nearly a month after a hatching, and when 1.4 cm. long about a month and half after hatching, each of the dorsal spines being formed in turn from the posterior one. But his fighting qualities begin to ap-

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* Jour Scie. Hiroshima Univ. = Journal of Science, Hiroshima University published by the Faculty of Science. Hiroshima University, Hiroshima.

pear when he reaches about 24 cm. long. The coloration of the sexes becomes distinctly different when the fish are about 2.3 cm. to 2.4 cm. long (about 80 days to 90 days after the hatching). On the spawning period arriving, the male coloration gradually assumes a dark bluish black color, but the female coloration does not change). Though the spawning season is between the last decade of January and that of June, they do not all breed during this season, but in succession as they mature. Preparatory to the nest building, the male first obtains a desirable sheltered place in the shadows of aquatic plants and clears it, and then he makes a foundation with bits of soft material, in form like a small basket laid on its side and having two pores, one is front and in back. The nest, when completed, is an almost spherical hollow about 3.5 cm. in diameter, and has one frontal pore; but the back wall, where the other pore was, is thin and usually has some crevices. When the male, having completed his nest, seeks his mate, he draws near her, raising all his spines, fully spreading his dorsal fins, and oscillating his caudal fin swiftly; assuming a darker color, and bending his body is a S-shaped form or reserve S-shaped form opposite to her; but never obliges her to lay her ova by attacking her. No sooner has the female taken her departure, by breaking out through the back wall, than the male immediately enters and deposits his melt on the eggs, which he does each time a female lays eggs, without exception the male seems to introduce 3 to 10 females into his nest for a few days, and after that he does not usually introduce any more. All the eggs in the nest are glued together in one or two masses, but all of them hatch out at much the same time, about 9 or 10 days after the egg-laying. The male, having finished his protection of the eggs and frys conceal in sheltered parts of aquatic plants, grows weak to die at last.

MAKINO, SAJIRÔ, 1933: Chromosome Number of Salmon. Bot. & Zool., 1 (12), pp. 1837–1838. (in Japanese).

The author has observed the chromosomes in the cells of the germinal ridge of just hatching out embryos of *Oncorhynchus keta* (WALBAUM). He has counted 74 chromosomes on the equatorial plates. Generally 20 chromosomes are V shaped and the rest are long and short rod shaped ones.

MATSUI, YOSHIICHI, 1933; Notes on the Peculiar Race of Goldfish, called "Jikin" in Aichi Prefecture. Nihongakujitsukyokai Hôkoku, 8 (3), pp. 435–440. (in Japanese).

The author investigated the history and phylogeny of *Jikin*, one of the peculiar race of goldfish, breeding in Owari and Mikawa Provinces. This race is also called as "*Jigyoku*", "*Jikingyo*", "*Shachi*", "*Ainishiki Kujaku*" in these districts. Since 1600 years (KANBUN era), this race was breeding in Nagoya district and the author concluded that the race seemed to be derived from "*Wakin*" (a very primitive race). The body is somewhat elongated and caudal fin is divided into four, showing Z in shape. The body is white; head, mouth and fin are red.

MATSUI, YOSHIICHI, 1933: Preliminary Note on the Inheritance of Caudal and Anal Fins in Gold Fish of Japan. Proc. Imp. Acad, 9 (10), pp. 655–658.

The caudal fins of goldfish are classified into several sorts: "Funawo", "Tsumami-wo", "Mitsuwo", "Sakurawo", "Yotsuwo" and "Kyakowo". Except the "Funawo" which is vertical, all sorts of the caudal fin of the gold fish are horizontal and paired. The anal fin is also either single or double, with the intermediate forms of y-shaped and v-shaped, and in rare cases the anal fin is not present. He used the materials "Wakin", "Ryukin", "Ranchû", "Oranda-shishi-gashira", all sorts of "Demekin", "Jikin", "Shukin," "Hibuna" and "Funa" for the experiments.

MATSUI, YOSHIICHI, 1933: Genetical Studies of the Freshwater Fishes on the Male Sterility of *Cyprinus carpio* L. and *Carassius carassius* and its Varieties. Suisan Shikenjo Hôkoku, no. 3, pp. 249–257, pls. 1–5. (in Japanese with English summary).

Cyprinus carpio L. yield a hydrid when crossed with *Carassius carassius* or its varieties, and the hybrids grow to adult size, but in most cases the mlaes are sterile for they excrete no sperms. The males of hybrids show pearl organs as a secondary sexual character in the breeding season in spite of their ste-

rility. In hybrids the testes are almost degenerate in the breeding season and abormal spermatogenesis appears which, however produces on spermatozoa; in some cases the spermatocytes are destroyed. The cause of the sterility in the male hybrid, is undoubtedly this abnormal spermatogensis.

TOMIYAMA, ICHIRÔ, 1933: Notes on the Synonyms of *Tridentiger bifasciatus* STEINDACHNER and a New Species of the Genus *Tridentiger*. Zool. Mag., 45 (539), pp. 373–377. (in Japanese).

JORDAN, TANAKA and SNYDER mentioned 5 species; *T. obscurus*, *T. bucco*, *T. bifasciatus*, *T. marmoratus*, *T. genimaculatus* under the genus *Tridentiger*. The author collected many species belonging to *Tridentiger*, and identified *T. bucco*, *T. marmoratus*. *T. genimaculatus*. *T. rifissusioturus* under the synonym of *Tridenitger*. The old *T. bifasciata* after breeding has an elevated chin, flattened head, and it is undistinctive for the two lateral longitudinal ridges along the median axis. The body very black, and dorsal, ventral and caudal fins are black.

YAMAMOTO, TOKI-O, 1933: Studies on the Rhythmical Movements of the Early Embryo of *Oryzias latipes*. III. Temperature and the Amplitude of the Contraction Waves. Journ, Fac. Sci. Imp. Univ. Tokyo, 3 (2), pp. 105–110.

The writer considers important that how the temperature may alter the amplitude or the extent of the contraction. He makes some experiments of the eggs of *Oryzias latipes*. Conclusively, he says as follows. The relation between temperature and the amplitude of the contraction waves of the embryos of the embryos of *Oryzias latipes* was studied within the range of temperature from 7°C to 39°C. As the temperature is raised the amplitude of the contraction wave first increases and then decreases passing through a maximum at the vicinity of 15°C. Above 15°C and 29°C are quite in accordance with those previously found by him concerning the frequency of the rhythmical movements of the embryo. The possible factors controlling the amplitude of the wave are of physical nature, while those controlling the frequency are chemical ones.

YAMAMOTO, TOKI-O, 1933: Studies on the Rhythmical Movements of the Early Embryo of *Oryzias latipes*. IV. Temperature Constants for the Velocity of the Wave and for the Pause. Journ. Fac. Sci. Imp. Univ. Tôkyo, 3 (2), pp. 111–117.

The writer describes the Rhythmical Movements of the Embryo of *Oryzias latipes*. He concludes that the relation between temperature and the average velocity of the contraction wave and the pause were studied over a range of temperature from 9° to 39°C. The temperature constant A for the wave for upper temperatures was 5.0×10^3 and for lower temperature 8.5×10^3 with a "beak" at 29°C. The temperature constant A for the pause for upper temperatures was 7.4×10^3, for intermediate temperatures 14×10^3 and for lower temperatures 16×10^3 with two "breaks" at 27–29°C and 13–15°C. The controlling processes responsible for the velocity of the wave and for the pause are quite different, althought these processes may probably be connected in a catenary-way. The values of temperature constant A for the frequency are intermediate between those for the wave and for the pause. Therefore, the temperature characteristic μ for the frequency expressed in calories may not be the gram-molecular emeray of activation responsible for the specific catalyst, but is a constant determined by two temperature constants responsible for the velocity of the wave and for the pause.

1934

ABE, NOBORU, 1934: Galvanotropism of the Catfish: *Parasilurus asotus* (LINN.) Sci. Rep. Tôhoku Imp. Univ., ser. 4, 9 (4), pp. 393–406.

The author studies for the galvanotropic nature of the catfish. The results are as follows. It exhibits 4 different kinds of reactions in succession to gradually increasing electric currents: 1). the movement of upper barbels or fins, 2). swimming locomotion electronarcosis and finally 4). death. When the catfish is stimulated by the electric current repeated by in short intervals, the values for producing the galvanotaxic reaction tend to increase with repetition. The shorter the body length, the higher

is values of vo/L, but bewond a certain length, this relation is not clearly shown due probably to the sedentary life of older catfish.

FUJIMOTO, MASAO and YAMAMOTO, KÔJI, 1934: The Propagation of *Plecoglossus altivelis* hatched out from the Eggs transported into a Reservoir. Bull. Jap. Soc. Sci. Fish.,* 3 (1), pp. 31-36. (in Japanese).

The land-locked form of *Plecoglossus altivelis* is known to occur in Ikeda-ko and Unagi-ike, Kagoshima Prefecture; Oike, Miyazaki Prefecture and Sai-ko and Motosuko, Yamanashi Prefecture. The authors have also found a land-locked form in a reservoir Ungan, established in upper region of the Tantsuko River, Zenrahokudo, Korea.

FUJIMOTO, MASAO and YAMAMOTO, KÔJI, 1934: On the Formation and Propagation of land-locked Form of Ayu, *Plecoglossus altivelis*, by transplanting the fertilized Eggs in a Reservoir. Bull. Jap. Soc. Sci. Fish., Vol. 3, No. 1. (in Japanese with English summary).

The reservoir constructed in the River Soinjigang (Senshinko), Southern Korea entirely kept the anadromous *Plecoglossus altivelis*, from reaching the upper streams. In the autumns of 1928 and 1929, a considerably large amount of the artificially fertilized eggs of this fish were but by the present authors in the reservoir. From the summer of 1931, the present species is found land-locked there as in the case with that in Lake Biwa and is propagating well in spite of the rather low temperature of the water.

HOKKAIDÔ FISHERIES INSTITUTION, 1934: Researches of the Lakes in Hokkaidô; Lake Mashû and Dôya Lake. Suisan Chôșa Hôkoku,** Vol. 35, pp. 1-46. (in Japanese).

In Lake Mashû, there is no natural fish and the authorities are transplanting Rainbow trout as well as Steelhead trout (*Salmo gairdneri*). The last one, Steelhead is the most available in the lake. In Doya Lake, *Oncorhynchus nerka*, *O. masou*, *Salvelinus kundscha*, *Hypomesus olidus*, *Cyprinus carpio*, *Richardsonius hakuensis*, *Rhinogobius similis*.

HOKKAIDÔ FISHERIES INSTITUTION, 1934: Researches of the Lakes in Hokkaidô; Yudo Numa, Onne Numa, Notoriko. Suisan Chôsa Hokoku, Vol. 36, pp. 1-83. (in Japanese).

The authors mention many fishes of the three lakes. In Yudo-numa, *Platichthys stellatus*, *Hypomesus olidus*, *Aboma lactipes*, *Tridentiger obscurus*, *Myoxocephalus raninus*, *Chaenogobius macrognathus*, *Gasterosteus cataphlactus*, *Brachiopsis rostratus*, *Pygosteus brevispinosus*, *Osmerus dentex*, *Lumperus fowbri*, *Cottus pollux*, *Leuciscus hakonensis*, *Salvelinus kundscha*, *Salanx microdon*, *Clupea pallasi*, *Eleginus navaga*, *Hucho blachistoni*

In Onne-numa, *Salvelinus kundscha*, *Hypomesus japonicus*, *Osmerus dentex*, *Eleginus novaga*. *Leuciscus hakonensis*, *Clupea pallasi*, *Lampetra japonica*, *Platichthys stellatus*, *Liopsetta pinnifasciata*, *Brachiopsis rostratus*, *Myoxocephalus raminus*.

In Notori-ko, *Limanda angustirostris*, *Limanda schrenchi*, *Limanda iridorum*, *Verosper moseri*, *Platichthys stellatus*, *Clupea pallasi*, *Hypomesus olidus*, *Hypomesus japonicus*, *Salvelinus kundscha*, *Osmerus dentex*, *Hyporhamphus sajori*, *Eleginus novaga*, *Leuciscus hakonensis*, *Liza menada*, *Sebastodes schlegelii*, *Hexagrammos otaki*, *Gymnocanthus intermedius*.

HOKKAIDÔ FISHERIIES INSTITUTION, 1934: Researches of the Lokes in Hokkaidô; Lake Saroma, Suisan Chosa Hôkoku, Vol. 34. pp. 1-63. (in Japanese).

The authority describes many freshwater fishes of this lake. *Clupea pallasi*, *Hypomesus olidus*, *Hypomesus japonicus*, *Osmerus dentex*, *Salanx microdon*, *Leuciscus hakuensis*, *Hyporhamphus sajori*, *Liza menada*, *Sebas-*

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* Bull. Jap. Soc. Sci. Fish. = Bulletion of the Japanese Society of Science Fisheries published by the Japanese Society of Scientific Fisheries, Tôkyô.

** Suisan Chôsa Hôkoku = Report of Fisheries Investigation published by the Bureau of Fisheries, attached to the Ministry of Agriculture and Forestry, Tôkyô.

todes taczonwskii, Eleginus navaga, Sebastodes fuscencens, Platichthys stellatus, Liopsetta obscura, Abryois azumae, Oncorhynchus keta, Oncorhynchus gorbuscha.

IKEDA, HYÔJI, 1934: Correlation between the Scale Number Variations and the Caudal Length and the Body Height. Bot. & Zool. 2 (5), pp. 928–930. (in Japanese).

The author measured a hundred individuals collected from several rivers at Iwahune-gun, Niigata Prefecture during June to October of 1933, to investigate the correlation between the scale number and the caudal lenght and the body height. The number of scales varies in individuals and in localities while the number and the total body length do not exhibit the correlation between them. The relation between the body height and the caudal length shows the following formula during the growth.

$$a=h\pm, \qquad a=h\pm 0$$

a……oaudal length, h……body height.

IKEDA, KAHEI, 1934: The Variations of the Numbers of Fin Rays and the Dorsal Spines found in *Gasterosteus aculeatus aculeatus* and *G. aculeatus microcephalus*. Zool. Mag., 46 (554), pp. 553–572. (in Japanese).

The Vertebrae number of *Gasterosteus* is 29–33 from 412 specimens. In the marine form it is 31, with no local variations indicated, while in the land locked form the average number of vertebrae is 30 and there are indications that the number decreases from north to south. The number of fin rays of the dorsal and anal fins is found to be 13 and 10 respectively in the marine form while the land locked form has fewer rays numbering 12 and 9. From the number of dorsal spines and the fin rays between the head and the dorsal fin as well as the relation to vertebrae, the author distinguished 4 forms: the marine, the land locked, and peculiar variations in each.

IKEDA, KAHEI, 1934: Notes on the Variations of Vertebrae Number, the fin Rays and Dorsal Spines of land locked *Gasterosteus aculeatus aculeatus*. Zool. Mag., 46 (554), pp. 553–572. (in Japanese).

From the observations of 412 specimens of *G. aculeatus aculeatus*, the vertebrae number ranges from 29 to 33 and in the marine form usually numbered 31 while in the land locked form 30. In the marine form, local variation does not occur while in the land locked form the number decreases from north to south. The soft rays of the dorsal and anal fins of the marine form usually numbered 13 and 10 while those of land locked form are less one or two rays.

IKEDA, YUITIRÔ, 1934: Changes of Body Weight of *Oryzias latipes* in Anisotonic Media. Jour. Fac. Scie. Tôkyô Imp. Univ., 3 (3), pp. 505–507.

The writer describes the result of his experiment as follows. The osmotic changes of the body weight, the lethal effect of anisotonic media, and the limit of hypotonic hemolysis make it clear that *Oryzias latipes* is a homoiosmotic animal in hypotonic media so long as injurious effects of the solution do not set it. The hypertonic susceptibility does not seem to be attributed only to the exosmosis but to the destruction of the semipermeability of the body envelope.

ISHIKAWA, SHÔ, 1934: An Example of Intermediate Form of *Cyprinus carpio* and *Carassius auratus*. Suisangakkashi, 6 (2), pp. 99–100. (in Japanese)

MATSUI, Y. succeeded to make the hybrid between carp and crucian carp in 1931 by his interbreeding experiment. The author got a specimen from a fish culture pond attached to Atsumi Fish Culture Company, located at Izumi village, Atsumi-gun, Aichi Prefecture. The specimen measured 245mm. in body lenght, 95 mm. in height, 54 mm. in breadth, 74 mm. in head length, 529 g. in weight. It has a barbel; and two lines of lower pharyngeal teeth, a main of which has 4 somewhat flattened molar teeth. The age seems to be 3 years by the growth ring of scale. The gonad is underveloped. The characters described above and quite similar to those mentioned by Dr. MATSUI in 1931.

KAMOHARA, NENJI, 1934: Movements of Fishes in Urato Bay, Tosa, Kôchi Prefecture. Bot. & Zool.,* 2 (2), pp. 359-370. (in Japanese).

The movements of freshwater and marine fishes in Urato Bay are influenced mostly by the changes of water temperature and bottom conditions. Seven species of freshwater fishes descend from the Rivers Kozukawa and River Shimoda into the bay during the winter. Among these, *Leuciscus hakuensis* usually lives in the entrance of the river; when the breeding season comes in April to May, it ascends to the upper part of the river for spawning. The spawning of *Plecoglossus altivelis* usually occurred in the entrance of River Kagami and the young are caught by drag net ("Zibiki Ami") along the coast in December and January. The adult may grow to 16 cm. in body length in the Rivers Kagamigawa & Kozugawa.

KAMOHARA, NENJI, 1943: Freshwater Fishes of Tosa. Rakusuikaishi, 29 (6), pp. 55-57. (in Japanese).

The author listed 26 species of freshwater fishes from Tosa, Kôchi Prefecture. Two of them are the introduced species *Oncorhynchus irideus* ("Nizimasu"), *Gambusia affinis* ("Kadayashi"). The last one is said to have been introduced from China in 1897 (Meiji 30) by some people at Takaoka, Kôchi Prefecture.

KAMOHARA, NENJI, 1934: Further Notes on Fishes in the Vicinity of Kôchi City, Kôchi Prefecture (VI). Zool. Mag., 46 (549). pp. 299-303. (in Japanese).

In the present paper the author made and addition to the fish fauna in the vicinity of Kôchi City. *Acheilognathus moriokae* J. et TH. was found in Shimanto River and *Salmo fontinalis* was introduced into the rivers form the Yamagata Fisheries Experimental Station in December of 1933.

KINOSHITA, TOSHIYUKI, 1934: Notes on the Hermaphrodite of *Carassius auratus*. Zool. Mag., 46 (545), p. 73, (in Japanese).

The author found a hermaphroditic condition in a *Carassius auratus* measuring 33.5mm. long among the specimens collected at Gion, outside of Hiroshima City on October. This specimen shows a normal testis on the testis on the left side and containing testis on right side. According to SASAKI (1926), sex-ratio of the species exhibits 46.6 ♂ 100 ♀ in the smaller specimens measuring 30-40 mm, body length while in the larger ones of 50-60 mm. length the ratio changes to 7.9 ♂: 100 ♀. The hermaphroditic specimen is just in the middle between the stages of the changed sex-ratio. In *Carassius auratus*, the fish is a male with a gonad during the first 2 years and then changes into a female with ovaries during third and fourth years. Thus the sex reversal may occur in the male of 30-50 mm. length.

KOBAYASHI, HISAO, 1934: Notes on the various Forms of the Digestive Organs of Fishes. Bot. & Zool., 2 (11), pp. 96-98. (in Japanese).

The author made comparative observations on the digestive organs of common fishes. The most simple form of the alimentary canals appears in *Carassius carassius*, *Acheilognathus* and *Halichoeres poecilopterus*. The number of pyloric caeca is variable in different species. Salmon and trout have many caeca while *Ammodytes personatus* ("Ikanago") has only one. The various shapes of fish stomach were found and classified into several forms. The gall-bladder shows variation in form.

KOKUBO, SEIJI, 1934: On the Behaviour of Cat-fish in Response to Galvanic Stimuli. Sci. Rep. Tohoku Imp. Univ., 4 Ser. 9 (2-3), 87-96.

The Japanese cat-fish is quite sharply sensitive to stimulation. This habit may possibly indicate a relationship between the behaviour of this fish and the occurrence of earthquakes. The author has make some experiments to determine the reaction of catfish to a controllable galvanic current with a view to ascertaining whether or not the above mentioned sensitivity may be duplicated by certain la-

* Bot. & Zool. = Botany and Zoology published by Yôkendô Co. Ltd., Tôkyô.

boratorial galvanic conditions. He has confirmed that the mode and degree of reaction to the galvanic stimulus markedly differs according to the whether current is increasing or decreasing. The threshold of the jumping reaction of catfish is 3.8 volts with increasing current and 10.5 volts with decreasing current. The catfish becomes sensitive to the stimulus of knocking when a galvanic current of about 0.4 miliamperes is passed in an ascending direction. By control, the current intensity can be decreased to as weak as 10 microamperes, an intensity comparable with an earth current.

KOKUBO, SEIJI, 1934: Measurements of Chronaxie of *Parasilurus asotus* by Condenser Method. Zool. Mag., 46 (550), pp. 356-366. (in Japanese).

The author has tried to measure the chronaxie of *Parasilurus asotus* by the condenser method and has sought a way to determine the factor of transformation. His results are nearly the same as those published in the Science Reports of the Tôhoku Imperial University, 4 Series Biology, vol. 9, no. 2 & 3, in Sept., 1934.

MAKINO, SAJIRÔ, 1934: The Chromosomes of the Sticklebacks, *Pungitius tymensis* (NIKOLSKY) and *P. pungitius* (LINNAEUS). Cytologia,* 5 (2), pp. 155-168.

In *Pungitius tymensis*, the chromosome number is 42 in diploid and 21 in haploid. The spermatogonial chromosomes are arranged into 21 homologous pairs. They are taloned rod-shaped, straight or slightly curved and form the equatorial plate with 21 tetrads the horizontal ring. *Pungitius pungitius* shows no marked morphological differences or difference in number of chromosomes from the above species.

MATSUBARA, KIYOMATSU, 1934: Notes on a Salmon caught off Kumamoto Prefecture. Yôshoku Kaishi, 4 (6), pp. 114-117, figs. 1-2. (in Japanese).

On April 7, 1934, a trout weighing about 10 kans was obtained by the (Fixing gear) "Tsuboami", at Wakamiya sea-coast, Takasemura, Uji-gun, Kumamoto-Prefecture. The present specimen may be identified with *Oncorhynchus masou* from accounts by KITAHARA and OSHIMA. But it may be *O. ishikawae* by JORDAN et MCGREGOR or *Salmo milktschitsch* by TANAKA.

MATSUI, ISAO, 1934: Variations of outer Feature by Sexes of *Misgurnus anguillicaudatus*. Yôshoku Kaishi, 4 (9), pp. 164-168. (in Japanese).

He has compared the sexes of Japanese loaches and listed the characters in which they differ. The differences show in the ratio of body dimensions, the length of fins, and in the features of the cranium. The variation coefficient is larger in the female than in the male.

MATSUI, YOSHIICHI, 1934: Genetical Studies on Gold-fish of Japan. Journ. Imp. Fish. Inst., 30 (1) pp .1-96.

This paper is a conclusive report about the genetical studies of gold-fish of Japan treated previously by the present author. The results are already published in the previous papers in Japanese. The present report includes the following topics:

1. The varieties of gold-fish and the variations in their external characters. A. varieties of Japanese Gold-fish. B. variations in the external characters of Japanese Gold-fish. C. on the geneology of the Japanese Gold-fish. 2. On the mendelian inheritance of the Telescope Eyes of gold-fish. 3. On the Inheritance of the scale transparency of gold-fish. 4. On the Inheritance of caudal and anal fins of gold-fish.

MATSUI, YOSHIICHI, 1934: Notes on the Inheritance of the Telescoping Eyes of the Gold-fish. Suisan Koshujo Kenkyû Hôkoku, 30 (1), pp. 27-34. (in Japanese).

* Cytologia=Cytologia published by the Cytological Society of Japan, Tôkyô.

He has experimented with the interbreeding of goldfish with telescoping and normal eyes and discussed the inheritance of two kinds of eyes.

MATSUI, YOSHIICHI, 1934: Fourth Report Notes on the Inheritance of the Caudal and Anal Fins of Goldfish. Suisan Kôsyusyo Kenkyû Hôkoku, 30 (1), 61-82. (in Japanese).

He made genetical experiments on the inheritance of caudal and anal fins by "Wakin", "Ryûkin", "Orandashishigashira", "Sansyokudemekin", "Kurodemekin", "Akademekin", "Chôtengan", "Jikin", "Shûkin", "Hibuna" and "Funa".

MATSUI, YOSHIICHI, 1934: First Report on the Races of Goldfish and the Variation of outer Features. Suisan Kôsyusyo Kenkyû Hôkoku, 30 (1), pp. 1-82. (in Japanese).

He described the 16 races of Japanese goldfish and the variations of outer features related to body form, caudal fin, anal fin, dorsal fin, fin rays of pectoral fin and ventral fin, scales and to the sexual characters. He also discussed the phylogeny of Japaneses goldfish.

MATSUI, YOSHIICHI, 1934: 3rd Report on the Inheritance of Scale Transparency of Goldfish. Suisan Kôsyusyo Kenkyû Hôkoku, 30 (1), pp. 35-60. (in Japanese).

He has interbreed "Wakin", "Funa", "Akademekin", "Kurodemekin" as normal eye race and "Sanshoku-Demekin" a telescoping eye race.

MINAGAWA, HIROSHI and SAWAGURI KINO, 1934: List of Fishes found in Yoroigata, Niigata Prefecture. Bot Zool. 2 (3) pp. 606-608. (in Japanese).

The authors have described many fishes found in Yoroigata, Nishikanbara-gun, Niigata Prefecture, including 18 families and 34 species, those pure freshwater forms are included under 8 families and 20, and brakish form 2 families and 2 species (*Tridentiger obscurus* and *Hypomesus olidus*) as well as introducing form one family and one species (*Macropodus opercularis*).

MISHIO, SHINROKU, 1934: Studies on the Food of *Salvelinus malma* in Summer. J. S. L.* 3 (3), pp. 62-70. (in Japanese).

The writer observes the stomach contents of 289 individuals of *Salvelinus malma*. Most the contents are consisting of aquatic insects, as *Trichoptera*, *Diptera*, adult and larva of *Ephemera* and such air insects as *Coleoptera* and *Orthoptera*. In autumn, when the other trout ascend the river, it eat, their eggs and larvae by choice. In the case of *Salvelinus malma* which descends the river into the sea, the fish prefers to catch youngs of marine fishes and *Corbicula* (Bivalve Shell),

OKADA, SHUN, 1934: Sexual Difference of *Lefua nikkonis*. Bot. & Zool., 2 (11), pp. 1894-1895. (in Japanese).

The writer can find out the color difference in the both sexes of *Lefua nikkonis*. In the male, the ground color is yellowish golden, with a distinct black spot in the middle of the base of anal fin from where a black longitudinal line running to the posterior of the eye on the opercle. In the female, the base of caudal is black with a black spot but the longitudinal line is rather lighter and does not continue to the far anterior, disappearing nearly in the middle. In general, the male is somewhat brighter than the female. As for the size, the male is smaller than the female. In the sex-ratio, the male is less than female in number.

OSHIMA, MASAMITSU, 1934: *Macropodes* of Japan. Bot. & Zool., 2 (4), pp. 617-680. (in Japanese).

The author (1919) mentioned *Macropodes opercularis* (LINNAEUS) in Formosa, and he took *Macropodes filamentosus* from Botel Tobago for a new species. The new species is the male of this species with

* J. S. L. = The Japanese Journal of Limnology published by the Japanese Society of Limnology, Kyôto.

long, soft dorsal and anal fins and the middle soft ray of the caudal fin is filamentous like a tuft. *Macropodes* from Loo Choo is a species *Macropodes opercularis*. After the great earthquake in the Kantô district, some species appeared in the River Edo and the River Tsurumi which were identified *Macropodes sinensis* which is distributed in Korea. On the 30th of September, 1917, the large flood occurred in Tôkyô, and a pond of gold fish culturist was flooded over and the fish escaped to the River Ayase. At that time they were also spread from Ikegami Pond. Now they are distributing in Kôtô, Tsurumi and Rokugô districts also in Saitama and Kanagawa Prefectures.

SASAKI, KIICHIRÔ, 1934: Sexual Difference of *Carassius auratus*. Bot. & Zool., 2 (3), pp. 551-552. (in Japanese).

The writer observes many sexes of *Carassius auratus* and finds many differences between the male and female:

1. In the female, the head is somewhat larger and the trunk shorter than the male.
2. The height of the female is somewhat higher than that of the male.
3. The caudal of the female is somewhat larger than the male.

SUEHIRO, NORIO, 1934: Digestive Tracts and Food of *Tribolodon hakuensis*. Suisan Gakkai Hô, 6 (2), pp. 65-70. (in Japanese).

The author made an observation on the food-habits and alimentary canals of *Tribolodon hakuensis*. He concludes that the fish is omniborous. In lakes, the fish mostly feeds on *Cladocera* and in rivers, it feeds chiefly on *Dipteran* Larva. It feeds on other phytophagus natural food also. It is quite peculiar that it has no jaw teeth for catching natural food and no pharyngeal teeth for cracking food. It has no stomach to preserve food for a short time and pyloric caeca neither. From his constitution of digestive organs, we suppose that the fish will continuously swallow a large quantity of foods from which it takes nourishments. In fact, it is quite a rare case that the stomach of this fish is empty.

TAKAGI, SHUNZÔ, 1934: The Disposal of Worn-out Erythrocytes by Intestinal and Branchial Epithelia in Lamprey. Ann. Zool. Jap., 14 (4), pp. 397.

The author finds out that many erythrocytes in different phases of disintegration occur in the intestine and branchial epithelia. The intestinal epithelium of the animal consists of columnar cells with some gland cells between them. The epithelial cells very often contain erythrocytes and their debris. These are found also frequently to be contained in the gill epithelium. The erythrocytes or the debris derive themselves from the circulating blood, but that in what way they come to be contained in the epithelial cells remains unknown.

UZUKA, KIYOSHI, 1934: Some Notes on the Behavior of the Catfish, *Parasilurus asotus*, as seen through the Responses to Weak Electiric Current. Sci. Rep. Tôhoku Imp. Univ., 8 (4), pp. 369-381.

The author makes no special observations of catfishes in their natural habits but observes those kept in a small pond when assembled into a black mass. However, it was found that, in a small aquarium in the laboratory a single fish remained there as quiet as those that were assembled. The fishes were placed in a small aquarium in various numbers, but no remarkable differences were noticed but the fishes in a large assembly were more easily to be stirred up than the single or several fishes. From many experiments, he concludes that the respons of the catfish to the repeated stimuli with the copper rods, show considerable variation. But the responses may be classified into several types. The kinds of responses are dependent generally on the magnitude of the stimulus given.

YAMAMOTO, TOKI-O, 1934: On the Rhythmic Movements of the Egg of Goldfish. Jour. Fac. Scie. Tôkyo Imp. Univ., 3 (3), pp. 275-285.

It was in 1840 that RUSCONI firstly found out a certain movements, described a rotation, in the egg of pike. The author also observes in the egg of the goldfish rhythmical movements of the yolk ball start

when the egg reaches the 4-cell stage. They continue up to the stage of the closure of the blastoderm. These movements are due to the contractions of the protoplasmic layer in the wall of the yolk-ball. Temperature constant A ($=\mu/2$) is 6.5×10^3 for upper temperature and 10×10^3 for lower temperature, having a break at 17°C. The temperature constants for the movemetns indicate that the underlying chemical reactions of these protoplasmic movements are the same with those of the developmental processes.

1935

ABE, KEI, 1935: A Culture of Loach *Misgurnus anguillicaudatus* (CANTOR) (own publication in Japanese), pp. 1–115. Tôkyo Dainihon-Suisankai. (in Japanese).

This is a small book to describe all account the culture of Japanese loach. The report contains many topics about the loach as follows: the species of Japanese loach, its natural food, intestine respiration, the habit and water temperature change, burying into mud; rainfall and habit, sexual difference, spawning season and spawning habit, natural growth, mature age, the color and pattern changes in every different environment, and the development. He furthermore descrides the pond eel culture, rice-field eel culture, catching of natural eel, preservation over-winter hibernation, diseases and enemies, transportation, immigrated loach names, and the use of eel for nourishment.

ABE, NOBORU, 1935: Galvanotropism of the Catfish; *Parasilurus asotus* (LINN.), Sci. Rep. Tôhoku Imp. Univ., 4 Ser., Biology 9 (4), pp. 393–406.

Parasilurus asotus (LINN.), is said to show characteristic reactions on the occurrence of an earthquake in Japan. The author made the experiments of the galvanotropic nature of the catfish to evolve the fact above stated. The experiment was carried out at the Asamushi Marine Biological Station from the end of February to May in 1934. The results were as follows: The catfish exhibits four different kinds of reactions in succession to gradually increasing electric currents. 1) the movement of upper barbels of fins 2) active locomotion 3) electronarcosis 4) death. When the catfish is stimulated by the electric current repeatedly at short intervals, the values for producing the galvanotaxic reaction tend to increase with the repetition. The shorter the body length, the higher is the values of VoL, but beyond certain length, this relation is not clearly shown due probably to the sluggish life of older catfish. Essentially the catfish show along the equipotential lines.

ARAKI, KATSUJI, 1953: On the Ecolgy of *Salcocheilichthys variegatus* (TEMMINCK et SCHLEGEL) and its Propagation. The 16th Report of the Research Committee of the Freshwater Fish Culture in Japan, published by Shiga Prefecture Government. (in Japanese).

The author mentioned the details of ecology of *Salcocheilichthys variegatus*. Topics on general habits, spawning ground, spawning season, the relation between the number of eggs in the body and the number of eggs deposited and the spawning frequency, the development of eggs, the rate of growth, the living places and food of the young and of adult fish and status of the adult after spawning season are treated in this paper. Several experiments on propagation were carried out. 1). Experiments for the feeding of the young. 2). positive methods for propagation. To set a lot of bivalves in the breeding grounds for spawning To set an artificial apparatus for spawning and taking out the eggs to develop and hatch out. The best species of bibalves for helping the spawning of *Sarcocheilichthys variegatus* are "Marudobugai" *Anodonta calipygos* KOBELT, "Memkarasugai" *Cristaria plicata spatiosa* (CLESSIN), "Ishigai" *Lymnium douglasiae nipponense* (V. MARTENS), and others.

ATODA, KENJI, 1935: Young and Eggs of *Parasilurus asotus* LINNE. Zool. Mag., 47 (558), pp. 228–230. (in Japanese).

The author observed the development of eggs and young of *Parasilurus asotus* LINNE. and found one more pair of lower jaw barbels of the young lacking in the adult. The newly hatched larva measuring 4 mm. of body length, is provided with the anlage of one pair of upper jaw barbels and two pairs

of lower jaw barbels. The latter pair of the lower jaw is more developed than the former one. When the young attains 4.5cm. or more in body length, the second barbels gradually decrease in size and become slender. In the stage of young 6-7 cm. in length, the second barbels have quite disappeared.

FUKUDA, HIROWAZA, 1935: The Influence of Light on the Carp and Goldfish Egg and their Development. Yôshoku Kaishi, 5 (3,4), pp. 55-58. (in Japanese).

The writer made an experiment on the light influence of carp and goldfish. He also tried again this experiment on the 9th of May in 1934 with carp and also on the 31st of 1934 with goldfish. On the development of carp and goldfish, the body length was influenced by yellow, brown, white and no color. Generally the light color does not influence over the egg and the development.

GUMMA PREFECTURE FISHERIES EXPERIMENTAL STATION, 1935: Fishes of Gumma Prefecture. Rept. Gumma Fish. Stat.,* pp. 1-37.

This prefecture has about 30 freshwater fishes except two species of brackish water fishes. Here the list of the fish is shown belows.

1. *Lampetra mitsukuri.*
2. *Parasilurus asotus.*
3. *Pseudobagrus aurantiacus.*
4. *Pseudoperilampus typus.*
5. *Acheilognathus intermedium.*
6. *A. tabira.*
7. *Pseudorasbora parva.*
8. *Hemibarbus barbus.*
9. *Pseudogobio esocinus.*
10. *Sarcocheilichthys variegatus.*
11. *Leuciscus hakonensis.*
12. *Zacco platypus.*
13. *Carassius carassius.*
14. *Carassius auratus.*
15. *Cyprinus carpio.*
16. *Misgurnus anguilicaudatus.*
17. *Cobitis biwae.*
18. *Lefua echigonia.*
19. *Anguilla japonica.*
20. *Salmo keta.*
21. *Salmo milktschitch.*
22. *Salmo nerka.*
23. *S. irideus.*
24. *S. fontinalis.*
25. *S. malma.*
26. *Plecoglossus altivelis.*
27. *Hypomesus olidus.*
28. *Oryzias latipes.*
29. *Mugil cephalus.*
30. *Rhinogobius similis.*
31. *Chaenogobius macrognathus.*
32. *Cottus pollux.*
33. *Lateolabrax japonicus*

GUMMA, PREFECTURE FISHERIES EXPERIMENTAL STATION, 1935: Fishes of Gumma Prefecture. Gunma Pref., pp. 1-37. (in Japanese).

This paper contains an account of 33 species found in Gumma Prefecture. Most of them are freshwater fishes, 12 species of which belong to Cyprinidae occupied about one-third of the freshwater fishes of Gumma Prefecture, and the most of remainings 8 species are belong to Salmonidae. Cool water fishes such as salmon and trout are mostly distributed in the lakes and streams in the mountain regions. Warm water fishes such as Cyprinidae are mostly distributed in the rivers, ponds and swamps of the plain region. The smelts, trouts and eels are more important edible fishes and *Zacco platypus* and *Pseudogobio esocinus* less important for economic value. *Sarcocheilichthys variegatus* was introduced from Kasumigaura and found moderately in ponds and rivers of Yuraku-district. *Salmo nerka* (W.) was translocated from Towada Lake. *Salmo irideus* G. and *Salvelinus fontinalis* M. were also introduced.

HATAI, SHINKISHI, 1935: The Earthquake as one of the determining Factors of the Organismal Equilibrum in Nature. Rep. Fifth Pac. Scie. Cong.,** pp. 915-931.

* Rept. Gumma Fish. Stat. = Report of the Gumma Fisheries Station published by the Gumma Fisheries Station attached to the Gumma Prefecture Government, Maebashi, Gumma Prefecture.

** Rep. Fifth Pac. Scie. Cong. = Report of the Fifth Pacific Science Congress published by the Fifth Pacific Science Congress, Java.

The author reports on the realization of the occurrence earthquake from the behaviour of catfish. The forecasting of the earthquake by this fish was realized in 80%. of the trials which included numerous cases of obvious errors due to a sudden fallior rise of temperature etc. In Asamushi, Aomori Prefecture, earthquakes which effect the least seven to eight hours in advance are most frequent. The ultra-sensitivity of the catfish to sound stimulus leads us to suspect that a peculiar sort of vibration might be produced preliminary to the final occurrence of an earthquake, but at present there is not enough evidence to such an idea.

HÔZAWA, SANJI, 1935: Notes on the Gathering Place of *Leuciscus hakuensis*. Zool. Mag., 47 (557), pp. 197-199. (in Japanese).

The author has observed the crowds of *Leuciscus hakuensis* in a small pond, 30 meters and 15 meters in length, and breadth, located at the Daitoka Temple about 24 km. northeast of Ishinomaki, Miyagi Prefecture. This pond is 1-1.2 met. deep, with sandy bottom filled with very clear water, with 6°-15.5°C. water temperature during February to August. This is connected directly with the Tera River and Kitakami Rivers and with a branch of the Kamo River. The size of *Leuciscus hakuensis* found ranged from 16.5cm to 29cm. It may come up to this pond from the Kitakami River. In the breeding season, the fish decreased in number, as they descended to the main river. Their food may consist of rice given by many visitors of this temple. These conditions have conserved these fish from olden times to the present.

IKEDA, HYOJI, 1935: Fishes from Sugadaira, Nagano Prefecture. Hakudutsugaku Zasshi, 33 (56), pp. 162-164. (in Japanese)

The author has described four species of freshwater fishes collected at Sugadaira, situated at elevation of 1000m.-1200m., precisely speaking, from Kamikawa, a branch of Chikuma River of Nagano Prefecture. There are found two different phases of *Carassius auratus* in different localities.

ISHIDA, JURO, The Stomach of *Mugil cephalus* and its Digestive Enzymes. Ann. Zool.Jap., 15 (2), pp. 182-189.

The studies are the histological ones on the stomach of *Mugil cephalus* and their digestive enzymes. He finds out that in the stomach no gastric glands are present. In the extracts of the stomach are found amulase, glycogenase, maltase, invertase and trypsinogen, whereas neither erepsin norlipase is present. This fish being a plant eater, the amylotic digestion, but neither proteolytic nor lipolytic digestions, takes place in stomach. In general, the fish may be classified into the following 3 types from the structure and function of their stomachs: a. Fishes destitute of stomach, no pepsin secreted (Cyprinidae, Labridae, etc.); b. Fishes possessing stomach, pepsin secreted (Elasmobranch, *Gymnothorax*, *Esox*, etc.); and c. Fishes possessing stomach, but pepsin not secreted (Mugilidae).

KATAYAMA, MASAO, 1935: Biometric Study of Dog Salmon, *Oncorhynchus keta* (WALBAUM). Bull. Jap. Soc. Sci. Fish., 4 (3), pp. 171-173. (in Japanese).

The author summarized the present studies as follows: Sexual dimorphism. — The data is based on the records of the Hokkaidô Fisheries Experimental Station concerning four year old dog salmon, consisting of 151 males and 116 females, captured in North Kuril Islands. Males are larger than females in size. The ratio, body length/body height in the female is a little greater than that in the male, and two ratios, body length/head length and head length/snout length, in the female are considerably greater than those in the male. Correlations between body length and body height, body length and head length, head length and snout length, and head length and heigth of caudal peduncle respectively are comparatively high in both sexes and these are without exception higher in the male than in the female. Correlation coefficient between head length and snout length in the male is the greatest of all. The partial correlation of head and snout length in the male holding the date of capture constant, is much higher than the ordinary correlation between these characters, since there occurs

the prolongation of the snout in the male during this period. Races of dog salmon: According to S. KAWAKAMI the dog salmon of Hokkaidô is to be grouped into two distinct races, Pacific and Japan Sea, the latter of which may be subdivided into two races. For the distinction between the last two, he has given means and modes by the branchiostegals, developed dorsal fin rays, anal fin rays, gill rakers, and pyloric coeca. The results of the X^2-test applied on his data, pointed to the conclusion that according to all characters, except pyloric coeca, the two groups are really differentiated samples, and they may be safely separated into two races.

KAWAMOTO, NOBUYUKI, 1935: Physiology of Fishes. One of the Series of Experimental Biology, IV, published by Yôkendô, Tôkyô, Feb. 3, 1935, pp. 1-239. (in Japanese).

The author mentioned the general accounts of physiology of fishes. The following topics are treated in this volume.

1. Physiology of Circulatory organs.
2. Respiratory physiology.
3. Digestive physiology.
4. Physiology of air-bladder.
5. Physiology of Electric organ.
6. Skin physiology.
7. Excretory physiology.
8. Physiology of central nervous and peripheral nervous system.
9. Sense physiology.
10. Reproduction and growth.
11. Locomotion.
12. The relation between fishes and water.

KOBAYASHI, HISAO, 1935: Freshwater Fishes and their Parasites. pp. 1-148. published by Yôkendô, November 15, 1935. (in Japanese).

This book contains the following articles, 1. Freshwater fishes of Japan and the species number of parasites. 2. Key to the families of Japanese freshwater fishes. 3. Special descriptions of freshwater fishes. 4. General description and geographical distribution of freshwater fishes.

KOBAYASHI, HISAO, 1935: On the Scales of Ayu, *Plecoglossus altivelis* TEMMICK et SCHLEGEL. J. S. L., 6 (2), pp. 56-62.

The writer observed the details of scale of *Plecoglossus altivelis* from the specimens obtained at the River Nagara in November of 1935. The original scale occurs when the youngs measure 5cm. and the scale of this early stage has a weak circuli but not radii, a typical scale. The dorsal scale develops later than the lateral body scale. The outline of the scale is widely differentiated in the various part of body and in the same area. The scale situated in the middle of the body side, broad rather than long. An systematist has included it under the Salmonidae and from the old times they had agreed with him. But recently JORDAN et MCGREGORI distingshed this family Plecoglossidae from them in the following characters; the upper jaw not covering lower jaw and the last vertebra degenerated or curved upward. JORDAN & MCGREGORI examined the scales of this fish and found that they do not die year but last 3 or 4 years. They did not remark on the spawning mark and seemed to have supposed that it did not spawn for 4 years. But the spawning mark undistinctly seen on the scale. Whether an over-winter *Plecoglossus altivelis* has the spawning mark or a two year adult has a same spawning mark is now still the question.

KURODA, NAGAMICHI, 1935: What is "Ararekago". Bot. & Zool., 3 (6), p. 1197. (in Japanese).

"Ararekago" is a freshwater fish, belonging to *Cottus kazika* J. et S. called "Kamakiri" The Kuzuryû River of Fukui Prefecture is well known for this fish. *Rheopresbe fujiyamae* J. et S. called "Takitaro" is a synonyme of the present species. This fish descends to the brackish water in the breeding season and appears slender in shape after the mating season, looking quite different from "Kamakiri". From this fact, the present fish was considered as a distinct species and genus. After the breeding season, the fish die in the sea, near the river mouth. The author collected 8 fresh specimens at the mouth of the Matsukawa River, Ito, Izu Peninsula on March 28, 1921. They are rather smaller than Hôkuriku.

MAKINO, SAJIRÔ, 1935: Spermatozoa of Carp and Goldfish. Bot. & Zool., 3 (3), p. 642. (in Japanese).

The Spermatozoa of the both fish is well stained and cubical, not of flagellate form as shown in those of other vertebraetes. The spermatozoa of carp is somewhat larger measuring 0.9045mm. in diameter and that of goldfish measuing 0.0038mm. when they are Gimza Stainning.

MATSUI, ISAO, 1935: A Misform of Viscera in *Anguilla japonica*. Yôshoku Kaishi, 5 (1,2), pp. 23-25. (in Japanese).

A normal specimen has a large left liver lobes than the right ones, while an abnormal one is quite contrary, the right lobe slender, extending along the long intestine.

MATSUI ISAO, 1935: The Misform of *Misgurnus anguillicaudatus*, Yôshoku Kaishi, 5 (7,8), pp. 139-141. (in Japanese).

The author finds out the misform of the pectoral and ventral fins from the specimens collected at Nagano Prefecture, in the middle of July, 1934. This loach has normal caudal, dorsal and anal fins but a very degenerated pectoral fin also. The other misform shows a branched barbel; the normal barbel is 10 in number and unbranched while the misform has one of these usually branched.

MATSUI, YOSHIICHI, 1935: On the Inheritance of a new Scale Transparncy in Goldfish. J. J. G.,* 9 (2), pp. 107-112. (in Japanese).

He has reported the inheritance of scale transparency in goldfish.

MATSUI, YOSHIICHI, 1935: Notes on the Ascending of young Eels. Kagaku, 5 (6). (in Japanese).

The earlist the author has observed the first young eels ascending a river was on January 9, 1935 and the average temperature was above 10°C. since February 1. The size at this season was rather smaller than that of European eels, measuring 54-64mm. body length.

MATSUI, YOSHIICHI and OSHIMA, S. NOBUO, 1935: On the Feeding Studies of Fish Diet with Carp. 1. On the Composition of Fish Diet Materials. 2. On feeding Experiments of Synthetic Diet to Carp. Jour. Imp. Eish. Fxp. Stat. no. 6, pp. 181-220. (in Japanese).

1. On a comparison of fish diet materials: This experiment was carried out to determine the value of eleven kinds of food usually given in culturing fish, viz., raw and dried silkworm-pupae, refuse of fish (*Siaena albiflora*), salted cod roe fish-meal, "Shiomushi" (*Tectceps japonicus* IWASA), "Kotomushi" (Amphipoda), salted mysis (*Metamysis mitsukuri* and *Neomysis japonica*), wheat flour, bean-cake and crab-meat. Carp was used for the test. The growth does not correspond with the chemposition of the diet. The most palatable foods are fish meal, "Kotomushi" and "Shiomushi", Wheat flour, bean-cake, but silkworm pupae are not palatable. For promoting growth, the silkworm pupae are very effectve, cod roe, fish and crab meat next and the fish-meat is the last. There was no increase in body weight from the use of "Shiomushi", "Kotomushi" and mysis, but on the contrary, the weight was reduced by this food. From these facts we may concluded that it is not beneficial to restrict the food to one kind, but very nesessary to give a properly mixed diet, when the fish can not obtain plankton or other natural food.

2. On feeding experiments of synthetic diet in carp: For the fundamental study of predaring a suitable synthetic diet for fish culture, we made a variety of such diets differing in quantity and in nutritive elements. A diet containing a great quantity of protein of sardines and silkworm pupae caused a temporary sickness. The body weight could not be kept up on a diet without protein. Food deficiency in vitamines imped the body growth, but dificiency in salts did not affect the fish. A diet containing a large quantity of carbohydrates is suitable for taste and growth.

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* J. J. G. = Japanese Journal of Genetics published by the Japanese Society of Genetics, Mishima, Kanagawa Prefecture.

MATSUI, YOSHIICHI, and OSHIMA, S. NOBUO, 1935: On the Influence of Starvation on the Growth of Carp *Cyprinus carpio* L. II. Jour. Imp. Fish. Exp. Stat., (6), pp. 173–180. (in Japanese).

To solve the question whether the deprivation of food for a time is more effective in promoting the growth of carp than continuous and regular feeding, the author examined the effect on the growth in the case of 3 groups which had no food given them for 10, 20 and 40 days, respectively, the groups being then again all fed at the same time. The longer the period of starvaticn, the greater the growth of the fish on being subsequently fed, as the result of our observation of the fish throughout all the stages of their culture we found it took some time for a fish, which had been deprived of food, to regain the weight, and further more, that the longer the period of starvation the more limited were the final growth and weight of the fish. Thus the effect or non-effect of food-deprivation on the growth and food utilization of fish depends on the season in which the deprivation occurs.

MATSUSHITA, MASAKATSU, 1935: Observations on the Changes of the Secondary Sexual Characters of *Plecoglossus altivelis*, especially of the Anal Fin. Yoshoku-kaishi, 5 (5–6), pp. 90–100. (in Japanese).

The author examines the sexual characters of *Plecoglossus altivelis* at the River Ôi, Shizuoka Prefecture. He remarks on the sexual characters exhibited at the breeding period and on the proportional changes of the adult. He concludes that this fish is quite changeable during the breeding season by male and female. The changeability of the entire body length, head length and the body height is not so distinct. As for 100tl/hl, 100A/D, the male has somewhat changeable in the male and the height of female, somewhat higher than the male, is clearly influenced by the eggs in her body. The fin form varies sexually. Generally the male has larger and roundly margined fins. The length of the second soft ray of the anal fin in the female is nearly equal to the base of the anal fin, while in male, that is just the half. The base is somewhat longer in the male, measured about 1.2 times of that of the female. The second soft ray in the female is nearly 3 times of the Xth soft ray. Conclusively in the female, the anal fin has a shorter and the softer ray somewhat longer while in the male the anal fin has somewhat longer base and the soft ray is short.

MIYADI, DENZABURÔ, 1935: Freshwater Fishes of Kyoto-fuka. Kyoto-fuka Shiseki Meisho Tennenkinenbutsu Chôsa Hôkoku,* Vol. 16, pp. 1–46. (in Japanese).

The freshwater fishes distributed in Kyoto-fuka are included under 60 species. In the Yodo River system 52 species and in Yura River system 34 species are distributed, exceptiug catadromous and anadromous fishes. Compariing the number of fishes, there are more species in these river systems. The factors may be recognized that the rivers are connected with Biwa lake which was originated geologically in ancient time and the water temperatures in these river system are available to southern and northern fishes to live. The author made the desciptions of 60 species included under 18 families with many figures.

MIYAUTI, TAKEO, 1935: Observations on Food-Organisms of a Teleost, *Hypomesus olidus* PALLAS, Bull. Jap. Soc. Fish., 3 (5), pp. 281–283. (in Japanese).

The author makes some observations on the stomach contents of a teleost, *Hypomesus olidus*, and plankton organisms in Lake Kasumigaura of Ibaraki Prefecture. He concluded that the fish mostly feeds on such kind of small organisms as *Bosumina* and *Neomysis*. The fish takes a numerous numbers of the plankton all year round in March and April, a small insect, *Simulium crassitarsis* is taken by this fish and in summer time, a kind of small crustaceans *Sida*, *Limnocalanus* and fish fry as well as young shrimps.

NAKAMURA, SHUYA, 1935: A Table of Spawning of Fishes of Japan. Suisan Ken-kyûshi, 30 (5), 243–254. (in Japanese).

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* Kyoto-fuka Shiseki Meisho Tennenkinenbutsu Chôsa Hôkoku = Report of the Natural Monuments of Kyôto and the vicinity.

The author listed up the spawning of freshwater and marine fishes, from which the writer picked up the freshwater fish only.

1. *Entosphenus japonicus* (MARTENS). Hôkkaido 5–8; Yamagata Prefecture 5–7; Niigata Prefecture 4–6.
2. *Oncorhynchus masou* (BREVOORT). Hôkkaidô 7–8; Biwa Lake 10–11.
3. *Salmo irideus* GIBBONS. Aomori Prefecture 1–4.
4. *Salvelinus malma* (WALBAUM). Hôkkaidô 10; Nara 11.
5. *Plecoglossus altivelis*. T. et SCH., Kasumigaura 10–11; Tôkyô 10; Kishû 9–11; Lake Biwa 9–11.
6. *Osmerus dentex* STEINDACHNER. Hôkkaidô 5.
7. *Hypomesus olidus* (PALLAS). Kasumigaura 1–3.
8. *Salangichthys ishikawae* WAKIYA et TAKAHASHI. Kishû 2–3.
9. *S. microdon* BLEEKER. Kasumigaura 3–4.
10. *Parasilurus asotus* (L.). Kasumigaura 5–7.
11. *Fluvidraco nudiceps* (SAUVAGE). Lake Biwa 5–6.
12. *Pseudobagrus aurantiacus* (T. et SCH.). Kasumigaura 5–7
13. *Misgurnus anguillicaudatus* (T. et SCH.). Kasumigaura 6–8.
14. *Cobitis taenia*. LINN. Kasumigaura 6–8.
15. *Pseudoperilampus typus* BLEEKER. Kasumigaura 5–6.
16. *Ischikauia steenacker* (SAUVAGE). Lake Biwa 6–8.
17. *Acheilognathus lanceolatum* (T. et SCH.). Kasumigaura 5–6.
18. *Gnathopogon caelrescens* (SAUVAGE). Lake Biwa 4–6.
19. *G. biwae* (JORDAN et SNYDER). Lake Biwa 4–6.
20. *Hemibarbus barbus* (T. et SCH.). Kasumigaura 4–6; Lake Biwa 5–6; Nara 5–7.
21. *Pseudogobio esocinus* (T. et SCH.).
22. *Sarcocheirichthys variegatus* (T. et SCH.). Kasumigaura 4–6; Lake Biwa 4–5.
23. *Pseudrasbora parva* (T. et SCH.). Tôkyô 4: Kasumigaura 5–8; Nara 3–4.
24. *Tribolodon hakuensis* (GÜNTHER). Hôkkaidô 4; Kasumigaura 4–5; Tôkyô 3; Kishyû 3: Tosa 4–5.
25. *Zacco platypus* (T. et SCH.). Shizuoka 8; Lake Biwa 5–6; Nara 6–8.
26. *Opsariichthys uncirostris* (T. et SCH.). Kasumegaura 8; Lake Biwa 5–7.
27. *Cyprinus carpio* (L.). Ibaraki Prefecture: Tôkyô; Kominato; Nara 5; Shizuoka Prefecture 5; Kasumigaura 4–6; Lake Biwa 5–9.
28. *Carassius auratus* (LINN.). Kasumigaura 4–7; Lake Biwa 4–6; Kishô 5.
29. *Oryzias latipes* (T. et SCH.). Kasumigaura 6; 4–6.
30. *Gasterosteus aculeatus* (T. et SCH.). Niigata Prefecture 4–6.
31. *Mugil cepahlus*. L. Kominato 10–2; Kishô 10; Tosa 10.
32. *Lateolabrax japonicus* (C. et VAL.). Inubozaki 10–11; Wada, Shiroko 2, Tosa 11–4.
33. *Rhinogobius isaza* TANAKA. Lake Biwa 4–6.
34. *Chasmichthys gulosus* (GUICHENOT). Kominato 2–5.
35. *Acanthogobius flavimanus* (T. et SCH.). Kasumigaura 3–4; Tosa 2–3.
36. *Tridentiger obscurus* (T. et SCH.). Kasumigaura 5–8; Yamanashi 5–6; Tosa 2–3.

NISHI, TAKEO, 1935: – The Propagation Method of Dice. Teisui,* 14 (8). pp. 1–5. (in Japanese).

This report is an introduction to the artificial propagation of dice, carried out by the Makisho Fisheries assemblage located at Ueda city, Nagano Prefecture. They made a special place for depositing eggs of dice and after spawning, they removed eggs into a hatching pond located along the bed of Chikuma River to hatch. The percentage of hatching out indicating shows a very high 60% minimum and 99% maximum. The incubation period continues 4–8 days, after hatching out, the embryo may be discharge into the rivers.

OKADA, SHUN, 1935: Breeding Habits of *Leuciscus hakonensis* GÜNTHER. Zool. Mag., 47 (566), 778–

* Teisui = Magazine of Fisheries published by the Society of Fisheries, Tôkyô.

783. (in Japanese).

He made observations on the breeding habits of *Leuciscus hakonensis* GÜNTHER in the Chitose River Hokkaidô. The beginning of the spawning season is usually from the first of July when water temperature rises to 13–15°C. In the southern part of Hokkaidô, the breeding season is somewhat earlier than in the north, occurring mostly from May to June. The breeding ground is the bottom of a shallow river, consisting of pebbles or stones. At spawning, about ten fishes congregate in shoals about the breeding ground to dig in the bottom of the river. During this action, the males and females are very active, often jumping up from the surface of the water. Then the females deposited the eggs deeply under the bottom. During the spawning season, the fish ascend to the upper region of the river. After the season, the fish suddenly leave the breeding ground and descend to the lower region of the river. The hatched larvae are concealed under the pebbles for a short time, and when they attain a body length of 11mm., they are observed with yolk sac escaping from the breeding grounds. After the first of August, the young, of 15mm. in body length, come to the slow water current along the edge of the river. In general, males are more numerous than females. The author noted that during the spawning season the larger females measured about 20 cm. in body length and the males about 10cm. body length. Nuptial colors and pearl organs are exhibited on the male, and they are rather distinct in larger specimens. Eggs demersal and adhesive, yellow, measured 2.5cm. in diameter. About 600–4000 eggs are deposited at one time. Hatching takes place in 11–13 days after fertilization when water temperature is $10° \pm 0.5°C$. The larvae just hatching out measured 6.0–6.5 mm. in body length. The sac is pear-shaped and yellow.

OKADA, SHUN, 1935: Breeding Habits of *Leuciscus hakonensis* GÜNTHER. Zool. Mag., 47 (566), pp. 778–783. (in Japanese).

The author made observations on the breeding habits of *Leuciscus hakonensis* GÜNTHER in the Chitose River, Hokkadô. The first appearance of the fish is usually on the first of July when the water temperature has raised to 13°–15°C. But in the southern part of Hokkaidô, the breeding season is somewhat earlier than in the northern part, mostly in May and June. The breeding ground is selected at the bottom of a shallow river containing pebbles and stones. At the breeding time about 10 fish form a group and gather to the breeding ground to dig the base. During this action, the males and females are very active, frequently jumping from the water surface, and deposite the eggs under the pebble basin. In the spawning season, the fish migrates to the upper region of the river and after the end of thsi season they disappear suddenly from the breeding ground, going down to the lower region of the river. The sex ratio has not yet been ascertained by the author but from the number caught in July of 1935, the females were 14 in number while males were 168. Generally the males are more abundant than the females. During the breeding season he found the females are mostly 20cm. in body length and the males rather smaller, measuring about 10cm. The nuptial colour and pearl organs appear in the males, being more distinct in larger specimen. But in the females they are weakly developed. Eggs, demersal and adhesive, yellow in colour, 2.5mm. in diameter. The females deposit the eggs on the surface of pebbles deeply buried under the river basin. They were spawned at several different times, about 600–4000 eggs in one time. The larva hatch out about 11–13 days after fertilization, feeding in the running water of $10° \pm 0.5C$. of water temperature. Just hatched larva measured 6.0–6.5 mm. in body length, were nearly transparent, without pigment. The yolk sac is pear-shaped, yellow in colour.

The hatched out larva are concealed under the pebbles and, when they attain about 11mm. in body length, they absorbed the yolk sac, and disappeared from the breeding grounds. From the beginning of August the young of 15 mm. body length are found swimming in the slow current of water along the river side.

OKADA, YAICHIRÔ, 1935: Pearl Organs of Japanese Cyprinidae. Nihongakuzitsu Kyôkai Hôkoku, 10 (3), pp. 734–735. (in Japanese).

The writer investigates the pearl organs of Japanese *Zacco*, *Opsariichthys*, *Pseudorasbora*, *Ischikauia*,

Acheilognathus, *Sarcocheilichthys*, *Carassius*, *Cyprinus*, *Tribolodon* belonging to *Cyprinidae* of Japan. They have the pearl organs in different situations which indicate some generic or specific characteristics.

SASAKI, KIICHIRÔ, 1935: Notes on Black Patterns of *Carassius auratus*. Bot. & Zool. 3 (9), pp. 1693-1696. (in Japanese).

The black spots and patterns appear on the skin of Crucian Carp, which we call by different Japanese local names; "Mousfuna" (The Lake Omi), "Kawahiwara funa" (The River Omi), "Umihiwara funa" (Lake Omi), "Tamari Hiwara" (Omi Province). This black pattern is influenced by the parasite of *Holostomus*. If the parasite *Holostomus* is found in this fish, the black patterns are more distinct by a lower temperature, and at an upper temperature, the black patterns are lighter. Generally the black patterns entirely are caused by the parasite of *Holostomus*.

SUEHIRO, NORIO, 1935: On the Development of Digestive System and Changes of Food of Fish. Zool. Mag., 47 (560), pp. 346-352, (in Japanese).

He mentions in this report the development of Digestive System and changes of food of *Plecoglossus altivelis*, from young to adult and declares how influnces were on the alimentary causal devlopment. He remarks that this fact is observed in the present fish. He mostly treats the marine youngs, measured from 14 mm. to 100 mm. in body length. In the youngs from 14 to 15 mm. no pharyngeal teeth grow and branchial stegals are undeveloped, and alimentary canal runs in straight, no distinction is between stomach and intestine, and undeveloped is pyloric caecum. The food is small, as *Halosphaera* or *Microcystis*. From this fact, the marine youngs may take micro-organisums before they take young of copepods or *Nauplius* larvae of other Crutstaceans. In the young of 35-45 mm., the orientation of digestive organs is nearly the same to those of the adult and the young changes into *Copepods* and bentic *Isopods*. The young measured 100mm. mostly ascends the river and takes phytophagus food instead of canivorous.

UCHIDA, KEITARÔ, 1935: Appendix on the Distribution of *Hyporhamphus kurumeus* JORDAN et STARKS. Zool. Mag., 47 558), pp. 231-235. (in Japanese).

The author shows an additional distribution of "Kurumesajori" (*Hyporhamphus kurumeus*). It is distributed in the River Arakawa (by Dr. TOMIYAMA), the River Kachi, Kasumigaura (UCHIDA), Ariake Sea, Fukuoka Prefecture, Fusan, Korea. The life history is unknown.

UEDA, SABURÔ and OKADA YOSHIKAZU. 1935: On the Food of the Salmonoid Fish, "Ayu" (*Plecoglossus altivelis* T. et SCH.), II. Bull. Jap. Soc. Scien. Fish., 3 (5), pp. 275-280. (in Japanese).

The authors make up for the defficiency of their conclusions in the first report by poor materials and here they make an extensive study on the food of *Plecoglossus altivelis*. They also mention the changes of food habits with ages. In the early stage when it is living in the sea or lake, it feeds entirely on zooplankton (*Copepods*, *Ostracods*, *Phyllopods*) until it attains 6 cm. in body length, even after its ascent of the river. Then, as it grows, the fish takes vegetative matters up to the time when it has grown up more than 9cm. Conclusively the fish takes as food both animal and vegetative matters during its growth from 6em. to 9 cm. in body length. It is also an interesting fact that the changes of food seem to show a tendency of seasonal variation and local differences. When the water temperature is high, blue green algae are mostly found in the food and in the case of low temperature, Diatoms are found. The local difference of the rivers relates to the change of the food. In the south of Japan, the fish takes mostly blue green algae and in the north chiefly *Diatoms*.

YAMOTO, TAKAHARU, 1935: Influence of the Sudden Change of Water Temperature on the Carp Fry. Bull. Jap. Soc. Fish., 3 (5), pp. 349-354. (in Japanese).

The author makes some observations on the influence of the Sudden Change of Water Temperature no the Carp Fry. He made an experiment by use of following equipments and methods. In two sets

of the SENÔ-TAUTI's thermostat, the compartments were so prepared as to be maintained each at about 9, 12, 15, 18, 20, 22, 27, 30, 33, 35 and 36°c and in each compartment were placed 2 or 3 vials, containing about 60 cc of clear water. The fry of common carp just hatched out, or those of 4 days old, were first put in the vials placed in 3 compartments at about 15, 22 and 30°c for about 12 hours, and then each transferred into one of the vials at several temperatures above mentioned. 12 and 24 hours after that time, the number of dead fry in each vial was examined.

1). The critical change of the water temperature, which is mortal for the carp fry varies according to the original temperature, as shown in the next table:-

Original temper. at which the carp fry keeping	*Critical sudden rise of temperature*	*Critical sudden fall of temperature*
15°c	+20°c	− 7°c
22	+15	−10
30	+ 7	−17

2). Aprupt fall of the water temperature from about 22°c the original one has more distinct mortal influence on the carp fry than the sudden rise.

3). No difference was appreciable between the fry just hatched and those 4-day old ones as to their resistance to the sudden change of water temperature.

YATSU, NAOHIDE, 1935: Recent Progress in the Studies of Gold-fish in Japan. XII Congress International de Zoologie Lisborne 1935. pp. 1678-1685.

The writer when attended to the XII International Congress of Zoology at Lisborne, read this report on the progress of the scientific works on Gold-fish in Japan by the following items.

1. Origin and introduction of Gold-fish in Japan. 2. Genetic Relationship between Gold-fish, Crucian and Carp. 3. Decolorization. 4. Extirpation of eye 5. How many standard races are there? How are they related to each other? 6. Genetics of the Gold-fish. 7. Regeneration of scales, transformation of ordinary scale into lateral line scale. 8. Relation between pearl organs and testes 9. Rhythmical movements of eggs.

YOSHIDA, HIROSHI, 1935: On the specific Difference of *Coilia* found around Japan Sea and the Identifications of Youngs, Zool. Mag., 47 (566), pp. 784-789.

The author distinguishes two species *Coilia mystus* (L.) (1758) = *Coilia nasus* SCHLEGEL (1846) and *Coilia ectenes* JORDAN et SEALE (1905). In the post-larval stage, he distinguishes the two species by following characters.

	No. of myotomes	*Fin rays, anal fin*	*Entire body length*	*Locality*	*Remarks*
Coilia	68	12	7.0	Chinnanpo, Korea	———
mystus	65	30	8.2	〃	———
	66	26+	10.0	〃	———
	68	44+	13.0	〃	Anlage of ventral fin and scale
	67	51+	15.0	〃	———
	67	65+	20.0	〃	———
	69	75+	23.0	Chinnanpo, Korea	———
	69	83+	26.5	〃	———
	69	85	27.0	〃	Scale covers whole body
	66	82	28.0	〃	Snout rounded
	68	80	29.0	〃	Snout projects, 2-3 keeled scale on the anterior of ventral

Coilia ectenes	78	76+	13.5	Rakutoko, Korea	Analge of scale on lateral side
	77	60+	15.5	Ariakekai, Japan	———
	76	60+	17.7	〃	———
	76	65+	19.5	〃	———
	78	85+	21.2	〃	Snout pointed
	78	82+	21.7	〃	———
	79	100	23.0	Rakutoko, Korea	Scales covers whole body

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ATOBA, K., 1936: The Innervation of the Cranial Nerves of the Catfish: *Parasilurus asotus* LINN., Sci. Rep. Tôhoku Imp. Univ., 4 ser., Biology, 11(1), pp. 91–113

In a former paper, the author mentioned three kinds of different typs of sense organs: viz., terminal buds or taste buds, small and large pit organs scattered over the entire body surface of the catfish. In the present paper, theauhor studied the innervation of the cranial nerves and mentioned the results of his investigation as follows. The trigeminal fascial complex is well-developed and very intricate, while, on the contrary, the eye-muscle nerves are all poorly developed. The terminal buds and small pit organs are freely scattered on the entire body surface, but much more plentiful on the head than trunk, while the large pit organs are not so plentiful on the head but are arranged transversely in many rows on the trunk.

EMURA, SHIGEO, 1936; The Tradition of one eyed Crucian Carp. Zool. Mag., 48 (11), p. 943. (in Japanese).

Professor YATSU reported very interesting examples of one-eyed Crucian carp found in Boga pond, Kushiike mura, Naka-Kubiki-gun, Niigata Prefecture and in Aono pond, Hokura, Naka-Kubiki-gun, Niigata Prefecture. the author asked to the authorites of this district and confirmed that one-eyed crucian carp is not natural product, but just only a tradition. New Aono-pond is one of artificial reservoir, breeding many carps and crucian carps but naturally one eyed crucian carp could not find out yet in that pond.

HAMAI, SYOZÔ, 1936: An Example of Caudal Deformation Carp. Zool. Mag., 48 (11), pp. 940–941. (in japanese).

The author made a note on an example of caudal deformation of a four year old carp specimen presented by My. SHINKAI TYUSAKU, the fish feeder at Shiraishi Machi' Miyagi, Prefecture. This carp, when fresh, is very inactive and can move about 50 cm. in a minute. The caudal fin is absolutely deformed and the anal fin serves as a substitute formation.

HAYAGURI, ISAO, 1936: Interbreeding of Trout. Suisan Ken-kyushi, 31 (5), pp. 251–258. (in Japanese).

The previous investigators mostly carried out the research on the F1 produced by interbreeding. The author makes the intexbseeder between *Salvelinvs pulvius*, s. *fontinalis* and *Oncorhynchus masou* and observes their F2.

HOKKAIDÔ FISHERIES INSTITUTION, 1936: Researches of the Lakes in Hokkaidô; Lake Panke, Penke, Kuttara, the Reservoir of the fourth Electric power of Oji Paper Manufacturing, at the River Chitose, Sounkyo, the River Shiri Betsu. Suisan Chosa Hôkoku, vol. 36, pp. 1–75. (in Japanese).

The authors discribe very few species in this report. Lake Panke is quite virgin a lake and has no experience for the trasportation of fishes from other countries. Few natural species there are as follows. *Salvelinus kundscha*, *S. pluvius*, *Leuciscus hakuensis*, *Cottus pollux* *Oreas oreas*. In Penke Lake, there

is only one species *Leuciscus hakuensis* found. In Lake Kutarako, there are found only the following 5 species *Leuciscus hakuensis, Cyprinus carpio, Carassius auratus, Oncorhynchus nerka, Cottus* sp.

IKEDA, HYÔJI, 1936: An Example of Deformation of *Tribolodon* sp. (♀) found in Akan Lake, Hokkaidô. Bot. & Zool. 4 (9), pp. 1549-1552. (in Japanese).

The author mentioned a malformation of pelvic girdle of *Tribolodon* sp., found in Lake, Akan Hokkaidô.

IKEDA, HYOJI, 1936: Statistical Observation on the Species of Genus *Tribolodon* in Aomori Prefecture and Notes on their Distribution. (in Japanese, with English summary). Zool. Mag., 48 (7), pp. 354-368. (in Japanese).

The splitting of the species of Genus *Tribolodon* in Japan into 3 species *T. iphalacrocorax* (JORDAN et FOWLER), *T. hakuensis* (GÜNTHER) and *T. jusanensis* (JORDAN et HUBBS) has been adapted by JORDAN and HUBBS. While on the contrary, TANAKA suggested the amalgamation of all these three species to one species, *Leuciscus hakuensis* (GÜNTHER). On account of the characteristics of the difference in number of scales which is propsed by JORDAN and HUBBS, I am able to distinguish the above mentioned three species descrcibed by JORDAN and HUBBS, and one more varied form which has 78-82, 79-89 scales in a lateral line. Considering the correlations among the number of scales in the lateral line and the scales before the dorsal fin, the lengths of body and the snout, I suggest that four species may be divided into two groups, the one with more than 77-80 scales on the lateral line (including *T. phalacrocorax* and *T. hakuensis*) and the one with less than 77-80 scales on the lateral line (including *U. jusanensis* and the varied form mentioned above). *T. hakuensis* is widely distributed in Aomori Prefecture but others are regional as follows: *T. phalacrocorax* Lake Osoreyama; *T. jusanensis* Lake Jusan, near Aomori? and Province of Mutsu? (JORDAN and HUBBS, 1925). The varied form aforementioned occurs in Lake Ogahara, Lake Obuchi, Lake Takaka.

IKEDA, HYÔJI, 1936: A Carp with two Barbels. Bot. & Zool. p. 2141. (in Japanese).

He has described a deformed carp with two barbels found in Ogawahara-numa, Numasaki-mura, Kamikita-gun, Aomori Prefecture.

IKEDA, HYÔJI, 1936: Sexual Characters of *Tribolodon hakuensis* (GÜNTHER). Zool. Mag., 48-54, pl. 1. (in Japanese).

Sexual differences of *T. hakuensis* (G,) are as follows. 1. In the breeding season, the female becomes thicker and deeper than the male. 2. The male pectoral, ventral and anal fins become longer, broader and tougher than those of the female. 3. Urino-gential papilla of the male is thicker than the female. Posterior edge of the opening is closer 4. The nupital coloration and the pearl organs appear in both sexes, but more distinct in the male than in the female. 5. These sexual characters are exhibited more distinctly in the freshwater form than in the brackish water form.

IKEDA, HYÔJI, 1936: Freshwater Fishes of Iwafune-gun, Niigata Prefecture. Hakubutsugaku Zasshi, vol. 34, no. 57, pp. 12-19. (in Japanese).

He has listed the 39 freshwater fishes belonging to 17 families and 24 genera, found in Miomote River, 50 km. long, and Arakawa River, 85 km. long.

IKEDA, HYÔJI, 1936: Freshwater Fishes of Aomori Prefecture. Hakubutsugaku Zasshi, vol. 34, no. 59, pp. 1-6. (in Japaese).

He has made a list of freshwater fishes collected in Aomori Prefecture. They are containd under 18 families and 30 genera. Among these fishes, the northern elements consist of 9 species while the southern ones of 5 species. Only one species *Pseudobagrus aurantiacus* (T. et SCH.) is distributed to the north of the middle of Honshû. From the result, there is found an areas of overlap between northern and southern species in the Aomori Prefecture. The species of this districts are as follows.

1. *Lampetra planeri* (B.)
2. *L. japonica* (M.)
3. *Oncorhynchus kega* (W.)
4. *O. masou* (B.)
5. *O. masou* (B.)
6. *Salvelinus pluvius* (H.)
7. *Hucho perryi* B.
8. *Plecoglossus altivelis* T. et SCH.
9. *Hypomesus olidus* (P.)
10. *Hy. japonicus* (B.)
11. *Salangichthys microdon* B.
12. *Parasilurus asotus* (L.)
13. *Pseudobagrus aurantiacus* (T. et SCH.)
14. *Carassius auratus* (G.)
15. *Cyprinus carpio* (L.)
16. *Acheilognathus moriokae*
17. *Hemibarbus barbus* (T. et SCH.)
18. *Phoxinus steindachneri* S.
19. *Tribolodon hakuensis* (G.)
20. *T. phalacrocorax* (J. et F.)
21. *T. jusanensis* (T. et H.)
22. *Misgurnus anguillicaudatus* (C.)
23. *Cobitis biwae* J. et S.
24. *Oryzias latipes* (T. et SCH.)
25. *Anguilla japonica* T. et SCH.
26. *Pygosteus sinensis* (G.)
27. *Gasterosteus aculeatus aculeatus* (L.)
28. *Hemirhampus sayori* (T. et SCH.)
29. *Mugil cepahlus* L.
30. *Liza menada* T.
31. *Lateolabrax japonicus* (CUV. et VALEN.)
32. *Cottus kazika* J. et S.
33. *Tridentiger obscurus* (T. et SCH.)
34. *Chaenogobius macrognathus* (B.)
35. *Acanthogobius fiavimanus* (T. et SCH.)
36. *Platichthys stellatus* (Pallas).

IKEDA, HYÔJI, 1936: Freshwater Fishes of Iwafune-gun, Niigata Prefecture. Hakubutsugaku Zasshi, vol. 34 no. 57, pp. 12–16 (in Japanese).

The 39 freshwater fishes are found in Miomote River, 50 km. long, and Arakawa River, 85 km. long.

IKEDA, HYOJI, 1936: On the sexual Dimorphism and the taxonomical Status of some Japanese Loaches. Zool. Mag., 48 (2), pp. 983-994. (in Japanese).

The author has distinggished the Japanese Ioaches into three species *Misgurnus anguillicaudatus, Cobitis taenia striata* by the sexual characters related to the structure of lamina circularis. In the genus *Cobitis,* the development of pearl organs found on the pecotral and ventral fins are rather distinct, From his observation, the common Japanese loach *Misg. anguillicaudatus* is quite different from the European *Misg. fossilis* and *Cobitis taenia* includes *Cobitis biwae* JORDAN et SNYDER and *C. taenia striata.*

IKEDA, KAHEI, 1936: Notes on the geographical Trends of *Gasterosteus.* Zool. Mag., 48(4), pp. 179, (in Japanese).

The author ascertained the geographical trends of *Gasterosteus* in the number of dorsal spines, scale plates and vertebrae. The number of vertebrae may decrease from north to south according to this paper.

INUKAI, TETSUO, 1936; Experiments on Release of young Salmon from the Hatchery directly into Seawater. Zool. Mag., 48, pp. 907, fig. 1. (in Japanese).

The author made some experiments on release of young salmon from the private hatchery by Mr. ASANO, Akkeshi, Hokkaidô, directly into seawater near the Akkeshi Marine Biological Station, attached to the Hokkaidô University. In the first series of his experiment which lasted for 4 days, the loss either in fresh water or in sea water was less then 2.5%. In the second series which lasted for two months, the loss within a month was 1.6% in sea water, while it exhibited 1.0% in fresh water. After 2 months, the loss freshwater attained 13% while in sea water only 3.5%. The longer the fry remain in seawater the better the result as compared with those remaining in freshwater. Generally there occurred on marked difference in the growth between the young in freshwater and those released into seawater. From these experiments it become clear that young salmon may be released directly into sea water without any harmful results.

KAWADA, TAKEO, 1936; Membrane Potential of the Egg of *Oryzias Iatipes.* Zool. Mag., 48, pp. 152–153. (in Japanese).

The author made the experiment on the membrane potential of the egg of *Oryzias Iatipes* by a galvanometer from this experiment, he suggested that the trip of the micro-electrode may give a negligible junction potential at its direct contact with the naked protoplasm, just as it is immersed directly into M/8 KCL. The membrane potential of the egg immersed in KCL solution of varying concentration was estimated, so as to obtain the so-called concentration effect of the potential. It may be said that when the egg is "conditioned" in a strong KCL solution, the differential permeability of cations and anions in the egg membrane is temporarily altered, although the effect disappears is the long run to give again the initial value of the membrane potential. The concentration effect of the membrane potential was examined in the eggs which were highly" conditioned in the way and the result was compared with that of the normal egg. It was shown that the concentration effect is temporarily argumented in the "coditioned concentrated soultion. It is therefore, not adequate to conclude that the augmented concentration effect in the "conditioned" state indicates a further increase in the difference between the mobility of cations and anions within the emembrane.

KOBAYASHI, HARUO, 1936; Individual Variations of *Carassius auratus* by Scale Number on the Lateral Line. Hakubutsu Gakkaishi, vol. 3, pp. 15-19, Hiroshima Normal College. (in Japanese).

The number of scales on the lateral line of *Carassius auratus* is quite variable in individuals of several specimens as described by the previous authors. TEMMINCK and SCHLEGEL described 30 scales on the lateral lines of *Carassius Iangsdorfii*, *C. burgeri*, *C. cuvieri* and *C. grandoculis*. TANAKA, SH. also mentioned 26 or 27 scales on the lateral line of his specimens. EBINA, K. described 28 scales and 33 scales rarely. The author has treated 63 specimens collected at Hiroshima and found the variable number of scales in each individuals found in same locality and in various different localitis. In some cases, the different number of the scale on lateral lines on each side are counted. From these datas, he summarized the assymetrical case of scale numbers shows 49. 0470:

KOBAYASHI, JUNICHIRÔ, 1936: Ecology of *Pungitius sinensis kaibarae* (TANAKA). published himself on February, 1936, pp. 1-5, (in Japanese).

The contents of the paper are nearly the same as the previous paper published by himself in 1933 in the Journal of Science of the Hiroshima Univ., Vol. 2. He has observed the seasonal migration, food, motion and struggle, colour, nesting, spawning, feeding, comparative morhology of Japanese Gasterosteid fishes and comparative ecology and conservation of the present species.

KOBAYASHI, JUNICHIRÔ, 1936: The Distribution of Freshwater Fishes of Japan. Zool. Mag. 48 (4), pp. 236-237. (in Japanese).

The area from the BLACKISTON's Line and WATASE's Line is occupied by the mixture of northern and southern forms of freshwater fish in Japan. The demarcation is shown from the River Takatsu, along the River Tama, to Chôshi. The line from Chôshi to the lake of Suwa is mentioned by Dr. TANAKA and the author also agrees with him. Here the line from Lake Suwa northward to the River Takatsu it now confirmed. In this area, *Hypomesus olidus* (PALLAS), *Pseudoperilampus typus* BLEEKER, *Entosphenus japonicus* (MARTENS) exhibit the southern line and the west is the River Sufu and the River Takatsu. The southern form are *Aluta alba* (GUIEW), *Sarcocheilichthys variegatus* (T. et SCH.), *Bryttosus kawamebari* (T. et S.) *Zezera hilgendorfi* ISHIKAWA, *Belligobio eristigma* JORDAN et HUBBS, *Pelteobagrus nudiceps* (SAUVAGE), *Biwia zezera* (ISHIKAWA,) *Rhinogobius similis* GILL, *Odontobutis obscura* (T. et S.).

KOBAYASHI, HARUÔ, 1936: Individual Variations of *Carassius auratus* by the Scale Number. Hakubutsu Gakkaishi, Vol. 3, pp. 15-19, published by the Natural History Society of Hiroshima Normal College. (in Japanese).

The number of scales on the lateral line of *Carassius auratus* is quite variable in the individuals of several specimens described by the previous authors. TEMMINCK and SCHLEGEL listed 30 scales on the lateral lines of *C. Iangsdorfii*, *C. burgeri*, *C. cuvieri* and *C. grandoculus*. TANAKA, SH. mentioned 26 scales and 27 scales in his papers. EBINA, K. reported 28 as an average and 33 in rare caces. The author has

observed 63 individuals collected in Hiroshima and found that the number of scales is variable and may differ on the two sides. Asymmetry of scale number in the lateral line was found in 49. 04% of the fish collected. This characteristic may be recognized as one of the hereditary factors.

KOBAYASHI, HISAO, 1936: Observations on the Scale of Japanese Cobitid Fishes I. Bot. & Zool., 4 (5), pp. 855-862. (in Japanese with English resume).

The writer wishes to distinguish the allied genera and species by the scale featare. Recently he treats the scales of Cobitidae taken from the center of the body side of adult fishes. The examined species are *Misgurnus anguillicaudatus. Lefua echigonia*, *Lefua nikkonis*, *Nemachilus barbatulus toni*, *Cobitis biwae*, *Hymenophysa curta.* In conclusion, he makes a generic key to this family, based on scale characters.

A. Scale circular
a. Nuclear area distinct in outline……*Misgurnus-M. anguillicaudatus* (CANTOR)
aa. Nuclear area indistinct in outline
b. Nuclear area without sculpture……*Cobitis*-C. biwae JORDAN et SNYDER
bb. Nuclear area with faint circuli……*Nemachilus-N. barbatula toni* (DYBOWSKY)
AA. Scale much broader than long……*Lefua-L. echigonia* J. et RICH, *L. nikkonis* (J. et FOWL.)
AAA. Scale much longer than broad……*Hymenophysa-H. curta* (T. et SCH.)

KOBAYASHI, HISAO, 1936: On the Scales of Ayu, *Plecoglossus altivelis* T. et Sch., J. J. L., 6 (2), pp. 56-62. (in Japanese).

Some systematist includes *Plecoglossus altivelis* under Salmonidae by the characters of upper and lower jaws but JORDAN and McGREGOR separate it from Salmonidae to include under the family Plecglossidae by the characteristic of lower and upper jaws as well as the last vertebra. The author agrees with them and adds some characteristics of scales which show the specificity of the fish.

KUBO, IZUO, 1936: Feeding Velocity of the Eel, *Anguilla japonica*, T. ct S., in Relation to Water Temperature and Other Environmental Conditions. Bull. Jap. Soc. Sci. Fish., 4(5), pp. 335-338.

The writer wishes to know how the cultured eel control the feeding velocity in the pond by the change of water temperature and other environments. He makes the experiments at the Yoshida Piscicultural Laboratory attached to the Imperial Fisheries Institution, oriented around the estuary of the Ooi River in the Shizuoka Prefecture during Ooi. 5 to Nov. 21 of 1934. Two kinds of ponds are ready for these experiments. The feeding velocity of the eel cultured in these ponds was measured by the weight of the food consumed by fish either in one minute (II) or in five minutes (I) and was found to stand in closer relation to water and air temperature read at each experiment. This relation can be said to be exponential for the majority of the data, deviations concurrent with unusually greater or smaller velocity of the wind. The air-pressure did not cause any effect on the feeding velocity.

KUBO, IZUO, 1936: The Spawning Habits and Early Development of *Oryzias latipes.* Yôshoku Kaishi, 5 (1,2), pp. 13-25. (in Japanese).

The author makes an observation on the spawning habits and embryological development. He concludes that the spawning begins in April and on to September (deposition is carried out mostly from 4 a.m. to 5 p.m.). The fertilization is carried by pseudocopulation. Just after the fertilization of the egg, the egg contains numerous small oil globules and exhibits yellowish with white color, and 1 hour after many globules gather to make a several large oil globules at the vegetative pole. 30-40 minutes after the hatchingout, germinal disc appears and the lst segmentation appears 1-1.5 hours after. The embryo hatches out in 10-20 days at 25°c of water temperature and it is 4.0-4.5mm in body length.

KUDÔ, TOKUYASU and **ASADA, TOYOMARO,** 1936; Notes on the Dimorphism of *Lampetra.* Zool. Mag., 48, pp. 521-533. (in Japanese).

During the year of 1931-1932, the author made the embryological research of *Lampetra* in Niigata

Prefecture and found the dimorphism among *Lampetra mitsukurii major* (HATTA) and *L. planeri*. He observed *Ammocoetes* of two species above mentioned and recognized all of these as may be included into the same species.

MATSUI, ISAO, 1936: An Example of Hermaphroditism in *Salmo irideus* GIBBONS. Kagaku,* 6 (12), pp. 506–507. (in Japanese).

An example of hermaphroditism in *Salmo irideus* GIBBONS was found in a specimen collected at Lake Mashû, Hokkaidô, on July 3, 1936. The right gonad was somewhat larger than the left. The testis comprized the anterior and posterior ends of the gonad and the ovary lay in the middle beween them.

MATSUI, ISAO, 1936: An Example of Number of Eggs contained by One Eel. Kagaku, 6(6), p. 1, (in Japanese).

The author examined the total number of eggs in one ovary from specimen measuring 92. 42 cm. in body length and weighing 1530 grms., collected at and inlet near Jinno Shinden Machi, Toyohashi City, Aichi Prefecture, on January 22, 1936. He sectioned the ovary and calculated all eggs in each section. From his observation, the ovaries are assymetrical, the left one heavier and longer than the right one. The total number is 7607625 with 4019965 in the left and 3588760 in the right with 3803812.5 as an average number in each ovary.

MATSUI, ISAO, 1936: On the Tongue and the Touge-Lappet of "Ayu," *Plecoglossus altivelis* T. et S. Bot. & Zool., 4(11), pp. 1906-1912, (in Japanese).

The author observed the tongue-lappet histologically for the relaton of food habits and its change. He studied the cultured "*Ayu*" in the Yoshida Laboratory of Fisheries College, and natural "*Ayu*" preserved in Toyohashi branch of Fisheries Experimental Station. Tongue-lappet consists of a main and lateral lappets, each of these is made of epithelial, connective and muscle tissues. The epithelial tissue contains many mucous cells, and taste buds. The main and middle tongue lappets are chiefly composed of connective tissue and the lateral tongue lappets are composed chiefly of muscle tissue. The epithelial tissue of the tongue somewhat thinner than that of the tongue-lappet and has smaller mucous cells. The tongue first of 1.6 cm. body length and the tongue-lappet in the fish of 4 cm. But when the fish reaches 6–7.5 cm. in body length, the tongue-lappet developes suddenly while the tongue may begin to degenerate.

MATSUI, ISAO, 1936: Notes on the Size of Ovarian Egg of Japanese Eel. Kagaku, 6 (4), pp. 136–138. (in Japanese).

He examined the ovaries of adult eels given by Mr. T. MISHIO, a staff member of the Shizuoka Fisheries Experimental Station, and found the largest ovarian egg to be 0.31 mm. diameter, which size was never seen before. He also noted that 16.2% of adult eels from many localities of Japan contained well ripened eggs when descending from the upper region of the rivers. From these facts the eels in the Pacific may spawn during the beginning of spring and the beginning of summer as those in the Atlantic. He has guessed that the spawning grounds may be found in the vicinity of the Japan Sea because of the ripened condition of eggs and the size of *Leptocephalus* is much smaller than that of European eels.

MATSUI, ISAO, 1936: Morphological Difference of Sex of *Anguilla japonica*. Yoshokukaishi, 6 (6), pp. 115–117. (in Japanese).

The author has studied many adults collected from 44 stations, located in rivers, lakes, swamps, and inlets. He has found differences in the external features between the sexes of the present species.

MATSUI, ISAO, 1936: Study on the Growth Curve of cultured Fishes. Daiippo Yoshoku Gyorui, 1st

* Kagaku=Science published monthly by the Iwanami Co. Ltd., Tôkyô.

Report. The relation between body length and body weight of cultured fishes. Suisan Kenkyushi, 31 (7), pp. 388-394. (in Japanese).

The author has studied eels, carps, Carassius, "Gengorobuna" (a kind of Carassius), Rainbow trout and Brook trout for the comparison of growth curves. He found the relations between the body length and weight as the following datas.

Eel.	W. = 0.000164	L. 3,6125	L. = 11.159	W. 0.2768
Carps.	W. = 0.0229	L. 3.0399	L. = 3.464	W. 0.3290
Carassius	W. = 0.0293	L. 3.0282	L. = 3.209	W. 0.3302
"Gengorobuna" (a kind of Carassius)	W. = 0 0240	L. 3.0922	L. = 3.342	W. 0.2768
Rainbow trout	W. = 0.0153	L. 3.0670	L. = 3.904	W. 0.3260
Brook trout	W. = 0.0417	L. 2.8963	L. = 3.710	W. 0.3453

MATSUI, ISAO, and **WAINAI, TEIICHIRÔ,** 1936: Egg Number of *Oncorhynchus adonis* (JORDAN et MCGREGOR) and decreasing Egg Number as well as the Assymetry of Ovary. Kagaku, 6 (11), pp. 462-464. (in Japanese).

This species (*Oncorhynchus nerka*) is a landlocked form of *O. adonis*. T. WAINAI introduced the species from Shikotsuko to Towadako in 1902. The phenomena of decreasing egg number may be based on the decrease in body length. The decrease in body length might be due to the narrow environment. In general, the number of eggs of *O. nerka* is counted about 1500 while that of *O. adonis* is half of this number. The ovary is assymetrical, the left one is larger than the right, containing a larger number of eggs.

MATSUI, YOSHIKAZU, 1936; Notes on the Intermediate Form of Freshwater Fish, found in Japan. Nihon Gakujitsukyôkai Hôkoku, 11 (1), pp. 84-86. (in Japanese).

The author has found the 28 interbreeding forms between crucian carp and common carp in 1933, and in those of which intermediate form indicates 3670. He also found the intermediate form between common carp and "Gengoro" crucian carp. By the result of the investgations of gonads of common carp, he found that the males have a normal development of testis while the females have various developmental periods of ovary.

MORI, TAMEZÔ, 1936; Preliminary Report of Freshwater Fishes in Asia. Zool. Mag., 48, pp. 180-181. (in Japanese).

The author mentioned that Russian Ichthyologist, Dr. BERG discussed the distribution of freshwater fishes in the wolrd. He divied the distributional area into Southern and Northern Regions and subregions. The subregions concerned to Asia, are circumpolar subregion and Indochina subregions. He also indicated a peculiar fish fauna of Kokuryuko and a transitional area including Enkaishû, Saghalien, Hokkaidô, Honshû, Shikoku, Kyushû, Eastern Korea, Southern Manchuria and Ryoga river. But the author has reversed BERGS' opinion and does not recognize the transitional area just mentioned before. He also included Hokkaidô, Enkaishû, Kankyô Nanhokudô, Korea, Kokuryukô into circumpolar subregion and Honshu, Shikoku, Kyushû, Korea, Southern Manchuria, North and Middle China into North China subregion. Finally he summarized as follows.

The Northern Zone --- Arctogaea

1. Holarctic Superregion
   A. Palaearctic Region:
      1. Circumpolar Subregion
         a. Siberian District
         b. Anadyr District
         c. Kamchatka District
         d. Amur District
         e. Maritime District
         f. Karafuto District
         g. Hokkaidô District
      2. North China Subregion
         a. North Hondô District
         b. South Japan District
         c. Chosen District
         d. North China District
         e. Middle and Lower Yangtse-Kiang District
         f. Upper Yangtse-Kiang District
      3. Mongolian Subregion
         a. Mongolian District

b. Tibetan District
4. Baikal Subregion
2. Palaeotropical Superregion
A. Oriental Rigion
1. Malay Sbregion
a. Taiwan District
b. South China District
c. Hainan District

NAGATA. YOSHIO, 1936: Transplantation of Testis into Ovariotomized *Oryzias latipes*. Zool. Mag., 48, pp. 102–108. (in Japanese).

The author made an experiment on the transplantation of testis into ovariotomized *Oryzias latipes*. On transplanting the testis into the ovariotomized female, the fish forms the processes on the and fin-rays which are characteristic to the male. When the testis has grafted during the breeding season of the fish, the processes appeared in 5 to 7 weeks after the operation while grafted out of the breeding season the appearance of the processes in delayed until the beginning of the following breeding season. Therefore, two facts can be recongnized (1) that there exists a correlation between the testis and the male processes in *Oryzias latipes* and (2) that the influence of the testis is active only in the breeding season. On examining the grafted testis microscopically, it was found that the spermatogenesis is somewhat retarded. In a single case, however, a testis containing oocyte-like cells was found. But the effect of this testis upon the secondary sexual characters does not differ least from that of the other testis. Since the apparition of such pseudoocytes in the normal testis is frequently met with, one of such testis must have been accidentaly used as a graft. Even when the removal of the ovary is not complete, the activity of the transplanted testis to produce the male processes does not seem to suffer any inhibitory influences from the part of the residual ovary; in other word so called "hormone antagonism" between both gonads is not yet observed in these cases. In some operated females, the male processes failed to be formed. Autopsy reveals that in these individuals the grafted gonads suffered degeneration and their cavities were invaded by the connective-tissue cells.

NAKAI, NOBUTAKA, 1936: Notes on Giant Eel from Nagano Prefecture. Suisan Ken-kyûshi, 31 (4), pp. 1-6. (in Japanese).

The writer find out a very large *Anguilla japonica* measured, 129.7 cm. in length and 5.1 kg. in weight, at the River Chikuma, Nagano Prefecture in the middle of August of 1935. By the microscopical observations, they show a very shrinked gonads which are very difficult to determine the sex. He supposes the age of this eel may have attained 17 years after ascending the river.

NAKAI, NOBUTAKA and MATSUI, ISAO, 1936: A Giant Eel found in Nagano Prefecture. Suisan Ken-kyûshi, 31 (4), pp. 161-168. (in Japanese).

The writers collected this specimen, measured 129.7cm. weight 5.1kg., at the River Chikuma, Nagano Prefecture. They identified this specimen with *Anguilla japonica* not with *Anguilla mauritiana*. The age of this specimen is supposed to be in 17th year after ascending the River. In the viscera, the gonad is withered.

NAKAI, NOBUTAKA and MATSUI, ISAO, 1936: On the Scales and Early Development of Chromatophpre of *Plecoglossus altivelis*. Suisan Ken-kyûshi, 31 (6), pp. 302-308. (in Japanese).

The authors make a research on the relation between the scale development and mucous cells of the young of *Plecoglossus altivelis* to determine the suitable sizes when it is transportig. The used many youngs measured 2.4–6.3cm. in body length, collected at Sunza, Lake Hamanako. The first appearance of the chomatophore is on the lateral line of caudal peduncle and then it proceeds anteriorly along the lateral line. The first scale has an elliptical outline and gradually the posterior margin grows faster than the anterior to make an oval in outline. The intervals of growthring is somewhat broader in the posterior part of the scaled youngs which have the let scale, measured 2.8–4.75 cm. in minimum size. The youngs which are covered whole surface of the bodies with scales measured 5.85–6.3cm. in body lengh. The development of the scale is shown earlier in the above of the lateral line than in the low. The fromation of guanin chromatophore is shown along the lateral line of the body, measured 4.2 cm. and it gradually developes on the entire surface of 6 cm. lengthened body.

NAKAI, NOBUTAKA, and MATSUI, ISAO, 1936: Studies on the Scale of *Plecoglossus altivelis* and Early Development of Chromatorphore, Suisan Kenkyushi, 31 (6), pp. 302-308. (in Japanese).

The writers make a study of the transportation of fresh "Ayu", especially in the relation between the scale and mucous cells. The lst scale develops on the lateral line of caudal and then it proceeds anteriorly. The minimum size of body which has the scale on the body is 2.8-4.75 cm. The body which has the scale on the whole, is measured 5.85-6.3 cm. Scale earlier develop on the left side than the right side. Guanophore formation begins to develop along the lateral side of the body measured 4.2 cm. The body over 6 cm. in length has guanophores and this fact has a deep relation with the scale development.

NIWA, HISASHI, 1936: Notes on the Geographical Distribution of the Fishes of the River Kiso. Nagoya Seibutsu Gakkai*, 4 (1), pp. 23-34. (in Japanese).

He makes a survey of the fish in the River Kiso during 1924 and 1936. He finds out the following 58 natural species and 4 transplanted species. Among these, the southern fish elements are rather more numerous while the northern fishes nearly absent.

OKADA, SHUN, 1936: Breeding Habits of A River Sculpin, *Cottus pollux* GÜNTHER. Zool. Mag., 48 (577), pp. 923-928. (in Japanese with English summary).

The writer observed the breeding habits of *Cottus pollux* GÜNTHER at the River Chitose, Iburi Province, Hokkaidô in 1936. The spawning season is two or three weeks after about 10th of May, when the water temperature of the river is about 9°c at noon. The spawning is held by several or more females. The adhesive eggs are laid under large stones, forming a mass of 2,000-4,000 eggs. The eggs are 3.5mm in diameter; yellow, orange, or red, varied with every egg, but mostly orange. The eggs found in a mature female are numbered 425, averaging 10 individuals. The incuvation period lasts about 4 weeks at the water temperature of 8°c. The number of male is very small, about 1/6 of that of the female.

OKADA, SHUN, 1936; Breeding Habits of a River Sculpin, *Cottus pollux* GÜNTHER. Zool. Mag., 48, pp. 923-928. (in Japanase).

The breeding habits of *Cottus pollux* were observed by the author in the Chitose River, Prov. Iburi, Hokkaidô during the spring of 1936. He summarized up the results as follows.

1. The spawning season occurs two or three weeks after about the 10th of May; the water temperature of the river at that season being about 9°c at noon. 2. The spawning is held by several or more females. The ahesive eggs are laid under large stones, forming a mass of 2,000–4,000 eggs. 3. The eggs are yellow, orange, reddish orange or red in color, on account of different individuals; but the orange colored egg commonly occurred. 4. The eggs measure about 3.5 mm in diameter. 5. The eggs found in a mature female are 425 numbers in an average of ten individuals, ranging from 650 to 307. 6. The number of the adult male is very small, being about 1/6 of that adult female. 7. The adult fishes ranged from 8.0 to 16.0 cm. in total length, and generally the male is larger than the female; the former ranges from 11.5 to 16.0 cm. the average being 14.1 cm. According to the measurement of 45 individuals, the latter ranges from 8.0 14.0 cm., the average being 10.7 cm. in 260 individuals. 8. The incubation period lats about 4 weeks in the water of 8°c.

OKADA, YAICHIRÔ and SEIISHI, REIZÔ, 1936: The Morphological and Ecological Studies of the Youngs of Freshwater Fishes of Japan. 1. *Pseudorasbora parva* (T. et Sch.). Suisan Kenkyushi, 31 (10), pp. 539-546. (in Japanese).

The writers describe many facts of this species, Morphology and Ecology of adult fish, the life cycle, larval stage, development of scale, the changes of ecology and morphology of the youngs and the food of each stage of youngs.

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*Nagoya Seibutsu Gakkai Kiroku = Bulletin of the Nagoya Biological Society published by the Nagoya Biological Society, Nagoya.

OKADA, YAICHIRÔ, and SEIISHI, REIZÔ, 1936: The Morphological and Ecological Studies of the Youngs of Freshwater Fishes of Japan. 2. *Acheilognathus lanceolata intermedia* (T. et SCH.). Suisan Ken-kyûshi, 31 (11), pp. 607-614. (in Japanese).

The writers mention the morphology and ecology of this fish. They further mention the life cycle, young stages, the development of scale, the change of the scale form, spawning season, the development of ovipositer and the development of barbels, and the food of each stage of youngs.

OKADA, YAICHIRÔ, and SEIISHI, REIZÔ, 1936: The Morphological and Ecological Studies of the Youngs of Freshwater Fishes of Japan. 3. *Zacco platypus* (T. et Sch.). Suisan Ken-kyûshi, 31 (12), pp. 687-696.(in Japanese).

In this report, they treats on the general aspects of *Zacco platyus* (T. et SCH.) At first they mention the morphology and Ecology of *Zacco platypus*. Then the life history, larval stage, youngs, the scale development, the food of every young and the changes of youngs ecologically and morphologically.

OKAMOTO, KIKUO, 1936: Morphological Studies on the Stomach Characteristics of Fishes. 1. Macroscopical Observation, Kyôto Igakuzassshi*, 2 (30), pp. 198-242.

The author examined 42 species of *Cyclostomata*, *Elasmobranchiata* and *Teleostei* of fishes. He made observations on the outer and inner features of many fish. He picked up some characteristics of many features. As for the outer characteristics, he observed the demarcation of oesophagus and stomach; the feature and length of pyloric caeca, the feature of stomach base, the features of pyloric stomach, its length, its breadth, the demarcation of intestine and stomach. Next, for the external features, he observed the demarcation of oesophagus, pyloric stomach; stomach base; pyloric caeca, cardiac stomach and the intestine demarcation. He makes detailed observation on each species and described in the present report. Here the author copies his conclusion iu Germany at follows:

1. Bei den Cyclostomen wird der Magen im Gebiete des Vorderdarmes nicht nachgewiesen, wie es bei den Dipnoërn der Fall ist. Die magenähnliche Erweiterung und Bildung der Pylorusklappe am Ende des Vorderdarmes bei den Ammocoeten, die von B. HALLER (1904) nachgewiesen wurden, konnte der Verf. bei einem 11.6 cm. langen Exemplare nicht beobachten. Die Reihe der Längsfalten der Schleimhaut bei dem *Bdellostoma cirrhatum* den Uebergang zwischen dem Schlund und Mitteldarm und vertritt die Stelle des Magens.

2. Unter den Elasmoblanchiern bildet der Magen bei Rochen u. Haien U-förmige Gestalt, ganz wie bei den Amphibien. Die älteren Forscher hatten schon bei den genannten Arten den Cardia-u. Pylorusteil unterschieden. Dennoch ist die Magenform bei den genannten Fischen je nach der Form der Leibeshöhle verschieden gestaltet, sodass der Magen bei Rochen mehr breit u. kurz, bei Haien dagegen mehr in die Länge gestreckt ist. Die Schleimhaut des Pylorusrohres von *Mustelus manazo* bildet nach dem Pylorus hin eine dicht gedrängte quere Faltenreihe.

3. Nach den älteren Angaben wie denen GEGENBAUER'S (1878), WIEDERSHEIM'S (1806), MAZZA'S (1894) soll der Magen bei den Holocephalen keine äusserlich merkbar differenzierte Gestalt entfalten.

4. Bei den Knochenfischen zeigt der Magen bei den verschiedenen Arten verschiedene Formen in seiner Gestaltung. Der Verf. will den Magen seiner Form nach in folgenden fünf Typen unterscheiden.

Typus I. Das Verdauungsrohr zeigt keine Differenzierung; somit fehlt der Magen sowohl äusserlich als auch innerlich gänzlich; höchstens bei den hierzu gehörigen Karpfen findet man an der Stelle, die dem Magen entsprechen soll, eine zierlich netzförmige Faltenbildung. Hierher gehören folgende Fisharten, welche zum Teil Pflanzenfressende sind. Unter Süsswasserbewohnern: 1. Cyrinidae, 2. Cobidae, 3. Cyprinodontidae; unter Seebewohnern: 4. Fistralia, 5. Solenostom, 6. Labridae, 7. Scaridae, 8. Blennidae, 9. Scidaemidae.

Typus II. Hierselbst ist der Magen als eine birn- od. spindelförmige Erweiterung zwischen dem

* Kyôto, Igakuzasshi. = Journal of the Medical, Society, Kyôto, published by the Kyôto Medical College, Kyôto.

Schlund- u. Mitteldarm differenziert und es lassen sich schon zwei Abschnitte, die Pars cardiaca und Pars pylorica, unterscheiden. Hierzu gehören z. B. Mormyridae, Esocidae, Gasterosteidae, Orizias, Gobidae, Exocoetidae u. a.

Typus III. Der Magen ist hier in zwei Schenkel umgebogen und bildet bald U-Form, bald V-Form, sodass er einen absteigenden und einen aufsteigenden Schenkel unterscheidet. Hierhin gehören z. B. Salmoidae (mit Ausnahme von Salmo), Chaetodontidae, Pleuronectidae, Callionymidae, Ostraciontidae, Tetraodontidae, Molidae u. a.

Typus IV. Der Magen ist Y-förmig, und bei ihm findet man ausser der Schenkelbildung noch eine caudalwärts sich verlängernden Fortsatz, den sog. Magenblindsak. Bei den mit einer lang gestreckten Körperform versehenen Fischen ist gerade dieser Magenblindsack sehr lang, während bei den mit einer mehr gleich dimensionierten Körperform versehenen der Letztere sehr kurz u. gedrängt ist; z. B.

Fische mit langem Blindsacke:

1. Chirocentridae,
2. Clupeidae,
3. Anguillidae,
4. Muraenosocidae,
5. Leptocephalidae,
6. Scombridae,
7. Serranidae,
8. Trichiuridae,
9. Lamprididae,
10. Trachypteridae,

Fische mit kurzem Blindsacke:

1. Elopidae,
2. Albulidae,
3. Siluridae,
4. Scopelidae,
5. Gadidae,
6. Percidae,
7. Mulidae,
8. Sparidae,
9. Carangidae,
10. Scorpanidae,
11. Triglidae,
12. Platycephalidae,
13. Balistidae,
14. Mastacenbranchidae,
15. Lophiidae,
16. Antennariidae.

Darunter haben die Scombridae (mit Ausnahme von *Scomber*) ein eigentümliches Lageverhältnis der Pars pylorica, wie der Verf. gefunden hat, indem hier der eigentliche aufsteigende Schenkel, d. h. die Pars pylorica, gerade die direkte Fortsetzung des absteigenden darstellt und der Blindsack sich beinahe zwischen den beiden Schenkeln eingeschaltet findet.

Typus V. Der Magen hat einen muskulösen Pylorusteil, d. h. den sog. Muskelmagen; derselbe wird ausschliesslich auf die Mugilidaeen beschränkt gefunden; der Verf. findet ihn bei dem *Mugil cephalus japonicus* kurz u. kreiselförmig. B. Haller (1904) gibt an, dass *Mugil cephalus* einen kräftigen Muskelmagen hinter dem Oesophagus, wie bei den Vögeln, besitzt und illustriert sein Lehrbuch (Fig. 736) mit irrtümlicher Abbildung. Mit E. Jacobshagen (1913) ist der Verf. ganz einverstanden, wenn der Autor darauf hinweist, dass "Haller's Figur unmöglich nach der Natur entworfen ist, sondern ein höchst schematisches Bild nach dem Gedächtnis." Der Verf. gibt an, dass der sog. Muskelmagen bei *Mugil* nichts anderes als ein machtig entwickelter Pylorusteil ist.

5. Was den Einfluss der Nahrungsart auf die Gestaltung und Grösse des Magens anbetrifft, so ist dies schon von manchen Forschern, wie Home (1807), Nuhn (1870), Brümmer (1876) u. a. geschildert worden. Diese Tatsache hat der Verf. auch bei den Fischen bestätigt gefunden, dass nämlich leicht verdauliche Kost, wie z. B. cellulosearme fein zersetzte Pflanzenteile, den Magen wenig zu belasten scheint. Unter den von solcher Kost lebenen Fischen haben z. B. die pflanzenfressende Teleostier, wie Cyprinidae, Labridae u. a., meist undifferenzierten Vorderdarm von primitiver Natur. Dagegen haben diejenigen, welche schwer verdauliche Nahrung aufnehmen und deren längeres Verweilen im Magen nötig haben, überhaupt eine grosse und komplizierte Magenform, nämlich wie bei deh Raubfischen, welche ausschliesslich von tierischer mit harten u. schwer verdaulichen Schalen u. Knochen behafteter Kost leben. Wie Pilliet u. Boulart (1895) richtig betont haben sehen wir eine gute Uebereinstimmung bei den wasserlebenden Säugern.

6. Zum Schlusse hat der Verf. den Einfluss des Alters auf die Magenform erforscht und bemerkt, dass man wenigstens bei den Fische, welche von der Brut an von keiner alternierenden Kost leben, keine Altersunterschiede beobachten kann. Hingegen solche wie *Plecoglossus, altivelis,* die bis ca. 15–16cm. Körperlänge von animaler Kost leben, haben anfangs y-förmigen mit kegelförmigem Magenblindsake. Aber über 15–16cm ausgewachsen, fressen die Fische blooss Diatomeenarten, und dementsprechend bildet der Blindsack sieh ganz zurück, so dass der Magen jetzt eine V-Form bekommt.

OZAKI, MASAO, 1936: Investigation in the Habit of *Oncorhynchus nerka* (Walbaum). Bot. & Zool., 4 (11), pp. 1869–1873. (in Japanese).

The writer invesitgates the habits of *Oncorhynchus nerka* (WALBAUM). The most important topics of this investigation are the number of eggs in the body, the spawning egg number, the hatching-out percentage of fertilized eggs, the remaining percentage of the hatched-out larvae completely absorve the yolk-sack, the remaining number of the going-out-to-the-sea larvae after the observation of yolk sac, the remaining number of returned fishes from the sea, and the fertilized eggs of two adult male and female developing into adult and, that how many adult, how should I know, returning into the river.

OSHIMA, MASAMITSU, 1936: Notes on the Scientific Name of *Oncorhynchus rhodurus* J. et McGR. and *Oncorhynchus masou* (BREV.). Keison Ihô,* 8 (29), pp. 1–11. (in Japanese).

He confirms the scientific names of Japanese trout and decides to use the following names. 1. "Sakuramasu" "Yamame" "Yamabe" *Oncorhynchus masou* (BREVOORT) 2. "Biwamasu" "Amenouwo" "Anago" "Enoha" *Oncorhynchus rhodurus* J. et MCGREGOR.

SAITÔ, TAMAO, 1936; Note on the Influence of the Sex Hormone Preparations upon the Nuptial Coloration of Fin and the Protrusion of Oviduct in *Acheilognathus intermedium.* Zool. Mag., 48, pp. 503–505. (in Japanese).

The author made on experiment on hormone effecting the second sexual characters of *Acheilognatus intermedium.* A single drop of Enarmon prepared from urine of the human male youth, in adult specimen of *Acheilognathus* in extranuptial period, effects the protrusion of oviduct within half an hour. By the injections of Synhormon and Puberozen, the nuptial coloration appears, though in a rather varying tint, in the dorsal and anal fin of the female within half an hour, with the injection of Enarmon into the female during the nuptial period, the protrusion of oviduct is accelerated to 3 cm within half an hour. Effect of Ovahormone, upon the female in the nuptial period is manifested in an over-protrusion of oviduct, a markedly dark tint on the second row of the drosal fin ray and a lesser tint of the pectoral fin. Reactions of a more prompt and intensive nature is produced in the female in the extranuptial period of vitamin E sample. Within quarter of an hour the caudal ridge of the dorsal and anal fins gets tinted freshly scarlet. In the female in the nuptial period the effect of injection is similar to that of ovahormone. It is well to be seen that each of the hormonal originating from different sexes works differently upon the female generic sphere of the fish and produces manifestations each differing in mode, grade and effecting station from the other.

SASAKI, CHUJIRÔ, 1936; *Cottus kajika* JORDAN et STARKS. Zool. Mag., 48, pp. 29–30. (in Japanese).

The author mentioned very large *Cottus* called "Ararekago, Aikake Gakoppu" in Japanese, distributed in the Kuzuryû River and Tsukumo River, Fukui Prefecture. He also described a very large fishing trap out of fresh bamboo in this district. The fishermen are using a trap in the middle of the Kuzuryû River during winter season to catch large *Cottus,* which is very tasty and delicious food.

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* Keison Ihô = Journal of Salmon and Trout published by the Hatching Laboratory, Hokkaidô, attached to the Fisheries Experiment Station, Hokkaidô' Sapporo.

SATO, MITSUO, 1936: The Fish with Barbels. Bot. & Zoo., 4 (4), pp. 791–792. (in Japanese).

The writer makes a list of the fish with barbels which were observed by previous authors. Here we get out of it a list of freshwater fishes only.

1). The freshwater Fishes with 2 barbels:
Gnathopogon elongatus T. et SCH.
G. biwae (J. et SNY).
Abbottina psegma JORD. et FOWLER.
Acheilognathus cyanostigma J. et FOW.
A. intermedius (T. et SCH.)
A. tabira JORD. et TOMP.
A. rhombeus T. et SCH.
Rhodeus miobuta TANAKA
R. limbatus (T. et SCH.)
Hemibarbus barbus (T. et SCH.)
Pseudogobio esocinus T. et SCH.
Belligobio erstigma J. et HUB.
Sarcocheilichthys variegatus (T. et SCH.)
Zezera hilgendorfi (ISHIKAWA)

2). The freshwater fishes with 4 barbels:
Acipenser mikadoi HILGENDORF
Parasilurus asotus (LINN.)
Cyprinus carpio LINNE.

3). The freshwater fish with 6 barbels:
Cobitis taenia LINNE.

4). The freshwater fish with 8 barbels:
Pelteobagrus nudiceps (SAUVAGE).
Pseudobagrus aurantiacus (T. et SCH.)
Liobagrus reini (HILGENDORF)
Lefua echigonia JORDAN et RICHARDSON
L. nikkonis (JORDAN et FOWLER).

5). The freshwater fish with 10 barbels:
Misgurnus anguillicaudatus

SATO, MITSUO, 1936: Studies on the Barbels of Fishes. 1. Histological Observations. Bot. & Zool., 1936, 4 (9), pp. 1579–1587. (in Japanese).

In general, the boeeom-feeding fishes have the barbels which serve for the tactile and taste organs. In this report, the writer treats several marine and freshwater fishes: the two spacies of freshwater fishes of which are *Cyprinus carpio* and *Misgurnus anguillicaudatus* (CANTOR).

TOMIYAMA, ICHIRÔ, 1936: Gobiidae of Japan. Jap. Jour. Zool., 7 (1), pp. 37–112.

The writer treats the Gobius fish in the vicinity of Japan where this fish show many local variations. From his study, we list up the freshwater gobid fish only here.

1. *Mogurnda obscura* (T. et Sch.). "Donko"
2. *Gobius giurinus* RUTTER. "Gokuraku-haze"
3. *G. similis* (GILL). "Yoshinobori"
   This is a polymorphic specis
4. *Awanus ocellaris* (BROUSSONET)
5. *Chaenogobius annularis urotaenia* (HILGENDORF) "Ukigori"
   This is distributed over in Hidaka, Hokkaidô Southward to Kawanabe, Kagoshima Prefecture.
6. *Tridentiger obscurus obscurus* (T. et Sch.) "Titibu"
   This is distributed from Hakodate to Loo-Choo.
7. *Sicydium japonica* TANAKA. "Bôzuhaze"
   This is distributed over from Yaita, Totigi Prefecture Southward down to Kawanabe, Kagoshima Prefecture, Amami-Ôshima.

TSUGE, HIDEOMI, and HANZAWA, SAKUICHIRÔ, 1936; A Regeneration of Spinal Cord of Fish. Zool. Mag., 48, p. 188 (in Japanese).

The regeneration of spinal cord in mammalia and lower vertebrates is not yet perfectly studied. The author made the experiments by using *Aplocheilus latipes* and confirmed the regeneration power of the spinal cord, mechanically and histologically.

UCHIDA, KEITARÔ, 1936: On the Distinctive Characteristics of the Two clcsely Allied Species, *Hemirhamphus sajori* and *H. kurumeus* (*Hemirhamphidae*). Zool. Mag. 48 (6), p. 295. (in Japanese).

The writer distinguishes two species morphologically and ecologically. In this report the writer are statistically treated some distinct morphological characristics of the two species, and further made some comparison of minor characristics and ecological aspects as the developmental stages. In the number of scales in longitudinal series, number of vertebrae, and the formula and total number of gill-rakers, the ranges of variation and model clattet of the two species are shown to be independent reciprocally. Among them, the number of vertebrae may be considered as a decisive feature in specific distinction. As to the ecological aspects, *H. kurumeus* lives chiefly in the brackish or freshwater, whereas *H. sajori* lives usually in the sea. The early larva carrying its yolk of *H. kurumeus* is considerably smaller than that of *H. sajori*. Both larvae are easily distinguished by the enumeration of the myotomes.

UEDA. SABURÔ and **OKADA, YOSHIKAZU,** 1936: On the Food of the Salmonoid Fish, "Ayu" (*Plecoglossus altivelis* T. et SCH.), Bull. Jap Soc. Sci. Fish., 6 (3), pp. 113-115. (in Japanese).

The two authors examined the food of "Ayu", *Plecoglossus altivelis* caught at several rivers of Gifu Prefecture to determine the difference of food in accordance of the difference of age. The "Ayu" of larger size chiefly takes an abundant quality of diatomes and blue-green algae. On the other hand, an "Ayu" of smaller size eats some green algae besicles and those above mentioned algae, all of which are poor in quantity but referable to pretty many kinds of species, and also takes some quantity sand and animal matters such as chironomid larvae and pupae as usual.

WADA, TAMEYOSHI, 1936; The Distribution of Salmonoid Fish of the Toyohirakawa, Sapporo, Hokkaidô. Zool. Mag., 48, pp. 218-219. (in Japanese).

The author found six Salmonoid fishes:- *Salvelinus malma* (WALBAUM), *S. kundscha* (PALLAS), *Oncorhynchus kisutch* (WALBAUM), *O. keta* (WALBAUM), *Plecoglossus altivelis* TEMMINCK et SCHLEGEL *Hucho peryi* (BREVOORT) and discussed about their distributions in this district.

WAKIYA, YÔJIRÔ, 1936; A Review of Salangidae. Zool. Mag., 48, pp. 835-845. (in Japanese with English Resume).

The author made a systematic revision of the Japanese Salangidae from the complete literatures concerned to Salangidae of many previous authors. He has discussed *Albula chinensis* and *Salanx fuscus* as well as *Eperlanus chinensis* in his paper.

1937

HOKKAIDÔ, KEISON FUKAJÔ, 1937; Number of Eggs deposited by the Trout in Chitose River, Hokkaidô. Keison Ihô, 9 (31), pp. 33-34. (in Japanese).

For several years, the authorities of the Chitose River Hatchery, Hokkaidô had an experience that the average number of eggs contained in one individual of "Sakuramasu" (*Oncorhynchus rhodurus*) is more than 3,000. According to their experiments, we could recognized the above said facts clearly by culture techniques or by the natural characteristics of "Sakuramasu" produced in the Chitose River, Hokkaidô, They have observed 20 females and counted 3.833 eggs in ever specimen. The results were as follows.

Locality/Eggs Number	*"Sakuramasu" produced in Chitose River*	*"Sakuramasu" produced in Nishibetsu*
Maximum	5.362	3.602
Average	3.822	2.720
Minimum	1.969	1.172

In general, the left ovary had more number of eggs than the right. The maximum difference was 1.550 between two and minimum was 49, averaging 320 eggs.

IKEDA, HYÔJI, 1937: Note of the *Gasterosteus aculeatus aculeatus* (L.). Kyushû. Suisankenkyushi, 32, (1), pp. 1-2, (in Japanese).

The northern catadromous fish *Gasterosteus aculeatus aculeatus* (L.) were caught in the southern part of Japan. One example was taken in the catching apparatus for *Plecoglossus altivelis* at Urakami River of Nagasaki Prefecture, at the end of March of 1936. The some example was caught in a fishing net at Ôita River of Ôita City, Ôita Prefecture at the end of March of 1936. These examples occur rather rarely in Japan.

IKEDA, HYÔJI, 1937: On the Sexual Dimorphism and the Taxonomical Status of Some Japanese Loaches (II), *Cobitis taenia japonica* SCHLEGEL. Zool. Mag., 49(1), pp 4-8. (in Japanese).

The author has distinguished the Japanese spinous loaches into three species *Cobitis taenia japonica*, *C. taenia striata* and *C. biwae* by the sexual characters. In *C. taenia japonica* the pearl organs appear on the pectoral fin and the sexual characters are closely allied to those of *C. taenia sinensis* SAUVAGE and D. de THIERSANT.

IKEDA, HYÔJI, and IDE, YOSHIO, 1937: Freshwater Fishes of Akita Prefecture. Nagoya Seibutsu Gakkai Kiroku, 5, 1, pp. 24-32. (in Japanese).

The author listed 37 species of 15 families in Akita Prefecture. The peculialitis of their distribution are as follows: *Hucho perryi* (B.) and *Hypomesus japonicus* (B.) distributed in Aomori Pref. are not found in this region. As to the species of *Pseudorasbora*, only one species *Pseudorasbora pumila* M. distributed in this prefecture instead of *P. parva* which is found in the neighbouring Yamagata Prefecture. The Chinese elements of freshwater fishes belonging to Cyprinidae are more numerous than those found in Aomori Prefecture. The southern elements are found to be more numerous in Akita Prefecture than in the neighbouring regions.

IKEDA, HYÔJI, 1937: Notes on the Distribution of Freshwater Fishes found in the Chikugo River, Fukuoka Prefecture. Hakubutsugaku Zasshi, 35 (6), pp. 108-118. (in Japanese).

The freshwater fish fauna of Chikugo River consists of three faunistic elements, the northern, Chinese, and southern. The most distinguished element is the Chinese element composed of 27 species while the other two elements have 7 species each. The southern element includes 7 species related to the South Chinese element, indicating the northern limit of each species in this region.

IKEDA, HYÔJI, 1937: On the Sexual Dimorphism and the Taxonomical Status of Some Japanese Loaches III. *Barbatula toni oreas* (JORDAN et FOWLER). Zool. Mag., 49 (5), pp. 173-177. (in Japanese with English summary).

For the scientific names of *Barbatula toni oreas*, previous authors have had quite different opinions. D. S. JORDAN and H. W. FOWLER (1903), D. S. JORDAN and C. L. HUBBS (1925) and SH. TANAKA took *Orthrias oreas* while L. S. BERG (1907) has regarded it as a subspecies of European, *Nemacheilus barbatulus toni*. H. W. FOWLER (1924) and T. MORI (1936) also combined the Japanese and the North Chinese species into one species, as *N. toni*. The author has made observations of the sexual and other characters and distinguished it from the European *Barbatula barbatulus*, regarding it as a subspecies of the East Asiatic species, and named it *Barbatula toni oreas* (JORDAN et FOWLER).

IKEDA, HYÔJI, 1937: Notes on the Fishes of Tôsi-Sima and Suga Sima of Mie Perfecture on the Pacific Coast of Japan. Hakubutsugaku Zasshi, 36 (62), pp. 582-589. (in Japanese).

He has listed the freshwater fishes from the small islands of Mie Prefecture, including 24 species, 9 families.

IWAKURA, CHIKASHI, 1937: Freshwater Fishes of Nagano Prefecture. Shinano Kyoiku,* April, pp. 1-6. (in Japanese).

The writer contributes the freshwater fishes of Nagano Prefecture by the collection preserved in the Mattumoto Girls' Normal School. The collection is consisting of 12 families and 37. species.

1. *Lampetra planeri*
2. *L. japonica*
3. *Oncorhynchus keta*
4. *O. masou*
5. *O. formosanus*
6. *O. adonis*
7. *Salmo irideus*
8. *Salvelinus pluvius*
9. *Plecoglossus altivelis*
10. *Hypomesus olidus*
11. *Parasilurus asotus*
12. *Liobagrus reini*
13. *Pelteobagrus nudiceps*
14. *Carassius auratus*
15. *Cyprinus carpio*
16. *Gnathopogon elongatus*
17. *Pseudorasbora parva*
18. *Acheilognathus lanceolatus*
19. *Ach. tabra*
20. *Pseudoperilampus typus*
21. *Hemibarbus barbus*
22. *Pseudogobio esocinus*
23. *Sarcocheilichthys variegatus*
24. *Zacco temmincki*
25. *Z. platypus*
26. *Phoxinus steindachneri*
27. *Tribolodon hakuenssis*
28. *Misgurnus anguillicaudatus*
29. *Cobitis taenia*
30. *Lefua echigonia*
31. *Oryzias latipes*
32. *Anguilla japonica*
33. *Cottus pollux*
34. *Rhinogobius similis*
35. *Chaenogobius macrognathus*

KOBAYASHI, HISAO, 1937: Comparative Studies on the Scales of Japanese Cyprinids. I-V, Bot. & Zool. pp. 5 (10), pp. 1801-1808 5 (11), pp. 2022-2030; 5 (12), pp. 2192-2198; 6 (7), pp. 1229-1236; 6 (9), pp. 1489-1510. (in Japanese).

In the first part, the author has given general descriptions of the scales of the Cyprinid fishes of Japan in respect to the outline of scales, focus, radii, circulii, growth lines and lateral lines. In the second part, he described the systematic observation of the Cyprinid scales. In the third and fourth he continued the general descriptions of cyprinoid scales. In the fifth part he concluded that all the Acheilognathinae fishes have the Acheilognathinae type of scales and have no remarkable differences of scales in 8 subspecies. Gobioninae type of scales and show the convergence of scales, which makes the classification of genera difficult**. *Gnathopogon elongatus* and *Gnathopogon el. suwae* have quite similar scale structure. Leuciscinae fishes have the scale type of Leuciscinae showing the divergence and difficulty for generic classification. Apical circulii of Leuciscinae scale is degenerated into a granular structure. *Phoxinus steindachneri* S. and *Ph. st. yamamotis* have similar scales. *Pseudorasbora parva* and *P. p. pumila* have the indentical scales. The scales of iron fish and gold fish are similar. The characteristic of the scale of *Carassius auratus* is the denticulation of the basal margin and in the central gathering of the radii.

KOBAYASHI, HISAO, 1937: On the Pearl Organs of some Japanese Fishes. Bot. & Zool., 5 (3), pp. 35-37. (in Japrnese).

The author has described some additional examples of the pearl organs of Japanese Cyprinid fishes

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* Shinano Kyôiku = Journal of Education, Nagano Prefecture published by the Sociey of Education, Nagano Prefecture.

which have not yet been mentoned by Y. OKADA in his previous papers. This author has found the pearl organs in the following species *Pseudoperilampus typus* B., *Tanakia miobuta* (T), *Acheilognathus lanceolata longipinus* R., *Ach. lanc. intermedia* (T. et SCH.), *Abbottina psegma* J. et F., *Gnathopogon elongatus* (T. et SCH.) and *Biwia zezera* (ISH.).

KOBAYASHI, HISAO, 1937: Ammocoetes of Two Species of *Lampetra in* Hokkaidô. Bot. & Zool. 5 (5), pp. 975-966. (in Japanese).

The writer describes two species of *Lampetra fluviatilis* and *Lamp. planeri*. But there are no detailed descriptions on the *Ammocoetes* except the number of myotomes by HUBBS (1924). The author mentions the habits and the number of myomeres of Ammocoetes.

KOBAYASHI, HISAO, 1937: Comparative Studies on the Scales of Japanese Cyprinidae (I). Bot. & Zool., 5 (10), pp. 1801-1808. (in Japanese).

This is the first report on the comparative studies on the scales of Japanese Cyprinids. In this report, he describes the introduction, general aspects of fish scale of Cyprinids, the outline of scale, focus, radii, circuli, growth line and lateral line scale.

KOBAYASHI, HISAO, 1937: Comparative Studies on the Scales of Japanese Cyprinidae (II). Bot. & Zool., 5 (11), pp. 2022-2030. (in Japanese).

In this second report, the author mentions the systematic observations of the scale on the Cyprinidae. First, he treats the Subfainnly Acheilognathinae, including *Pseudoperilampus typus. Tanakia miobuta, Rhodeus smithii, Acheilognathus lanceolata rhombea, A. lanceolata longipinnis, A. tabira, A. lanceolata moriokae, A. lanceolata limbata, A. lanceolata intermedia, A. cyanostigma, A. lanceolata lanceolata.*

KOBAYASHI, HISAO, 1937: Comparative Studies on the Scales of Japanese Cyprinidae (III). Bot. & Zool., 5 (12), pp. 2191-2198. (in Japanese).

In third report, the author mentions the subfaimly Gobioninae including *Sarcochelichthys variegatus, Abbottina psegma, Pungtungia hilgendorfii, Gnathopogon elongatus gracilis, G. e. elongatus, G. e. suwae, G. e. caerulescens, G. e. japonicus, G. e. biwae.*

KOMAI, TAKU, 1937: The Twin Embryo and reversed Visceral Organs of Salmon. Zool. Mag., 49, pp. 108-109. (in Japanese).

Deformed embryos were observed by the previous authors, mostly twin embryos and reversed viscera occurred in hatchery. The rich materials of deformed embryos were supplied from Chitose Hatchery, Hokkaidô by the courtesy of SHUN, OKADA. The author observed many materials comparativerly and included them into several types.

KOSHIDA, HIDEKANE, and MORITA, SHIGETSUGU, 1937: A Study of Loach Culture. Tôkyô Sugiyamashoten, pp.1-117. (in Japanese.).

This is a small book to explain the loach culture in Japan. The authors broach many important topics on the following questions. In the 1st chapter, the systematics, the characters of Teleostei, the species of the loach group, the features, ecology. In the second chapter, lectures on the utilization of rice-field for loaches. In the third, cooking, medicinal use. In the fourth chapter, the loach pond establishment. The determination of orientation of loach pond. The water qualification: suitable water nature for loach culture, spring water, pond water, river water, the suitable water temperature. In the fifth chapter, the propagation methotd; the selection of adult fishes (typical female and male), the sex ratio, the number of eggs in and adult female, the spawning pond and its constituent, character-

istic of eggs. In the sixth chapter, breeding of youngs and breeding of adults. In the seventh chapter, profits of this loach culture.

MAKINO, SAJIRÔ, 1937: On the Iron-Fish from Lake Chôboshi near Nemuro, Hokkaidô. Bot. & Zool., 5 (1), pp. 58-62. (in Japanese).

The author obtained 7 iron fishes from Lake Chôboshi near Nemuro, Hokkaidô. The Fisheries Assemblage transplanted about 3,000 individuals of *Carassius auratus* in the spring of 1906 from Aomori Prefecture into Chôboshi Lake. During 1915-1916, the fisheries were started and some of the iron-fishes were intermingled with the common Crusian carp in fishing in 1919-1920.

MAKINO, SAJIRÔ, 1937: Notes on the Chromosomes of Some Teleost Fishes. Zool. Mag., 49 (2), pp. 75-76. (in Japanese).

The author investigates on the chromosomes of some freshwater fishes. 1. *Misgurnus anguillicaudatus* in this species, the spermatogonium contains 52 well defined chromosomes in the metaphase plate. The chromosomes are all telomitic and in the metaphase of the primary spermatocyte 26. 2. *Oncorhynchus keta* (WALBAUM) the diploid number of chromosomes is found to be 74, after the examination of several good metaphase figures. The diploid complement consists of various kinds of telomitic and atelomitic chromosomes. At least 20 chromosomes among them seem to be provided with an atelomitic attachment of spindle fibre, appearing as the V-shape. 4. *Tribolodon jusanensis* (J. et H.)

MATSUI, ISAO, and WAINAI, TEIICHIRÔ, 1937: Ecological Studies of *Oncorhynchus adonis* J. et M. (1). Suisan Ken-kyûshi, 32 (8), pp. 418-433. (in Japanese).

He has studied the water layer in which the fish usually swim, the relation between the biological conditions and the number of fish, food habits, and movements. He concluded that the *Oncorhynchus adonis* prefers the temperature zones of 10.2-13.4 c. The swimming layer has oxygen saturation of 95-110% and 7.3-7.4 pH. The movements may be described as horizontal and vertical in search of food. The best fishing ground in the Lake Towada shows the greatest amount of plankton. The stomach contents are varied, consisting of three elements and indicates three groups.

MIURA, KANESUKE, 1937: Vertebrate Number of Salmonidae of Japan. Yoshoku-kaishi, 7 (3), pp. 68-69. (in Japanese).

The writer had a chance to observe the vertebrate number of 4 species *Oncorhynchus keta, O. masou, O. nerka, Salvelinus leucomaenis*.

He concludes into the following results.

Species.	*Average number of vertebrae*
On. keta	65.79
On. masou (landrocked form)	63.31
On. masou (silver form)	63.50
On. aerka	62.00
Salvelinus leucomaenis	60.46

MORITA, SHIGETSUGU, 1937: Studies on the Culture of Loach. pp. 1-118. (in Japanese).

The author described all about the loach for culture. In the first paragraph, the author mentioned the systematic position, species and its characteristics and morphological characters. In the second paragraph, the culture of loach was mentioned. The third paragraph, cooking of loach and uses for drugs were indicated. The fourth paragraph, the establishement of loach culture pond and in the fifth paragraph, the farming and breeding were included. In the sixth paragraph, the feeding and profits of this culture were discussed.

NIWA, HISASHI, 1937: A New Species of Cobitidae from Japan (*Cobitis delicate*), Zool. Mag., 49 (2), pp. 71–74. (in Japanese).

The author mentions a new species *Cobitis delicata* n. sp. in this report. By the account of his report, since 1924, the author had collected a large number of specimens from various places and found by their biometric and statistic investigation that there is a distinct discontinuity between the numerical properties of the form in question and *Cobitis biwae.* The differences separating it from *Cobitis biwae* and its allied species are so clear and remarkable, that the author proposes here to describe it as a new species.

OGAWA, KAZUO, 1937: The Distribution of Freshwater Fishes from Kagoshima Prefecture. Hakubutsugakkaishi, no. 5, pp. 11–27. (in Japanese).

The writer makes a study of distribution of freshwater fishes of Kagoshima Prefecture. He considers for the correlative distribution of freshwater fishes on Kagoshima and Loo Choo Islands and Northern Kyushû and Southern Kyushû. He also makes a remark on the relation of Southern and Northern Chinese continent. From these considerations, he concludes that the richness of freshwater fishes is most in both Northern Kyushû and Southern and Loo Choo Islands. The chief element of freshwater fishes of Kagoshima Prefecture is Chinese element and the northern and southern elements are mixed together. Ôsumi Channel shows a demarcation of southern and northern freshwater fish fauna.

OKADA, SHUN, 1937: Changes of External Form after the Metamorphosis of Japanese *Lampetra.* J. J. L., 7(1), pp. 1–8.

There are 2 species of *Lampetra* in Japan, *Lampetra fluviatilis* (Linn.) and *Lampetra planeri* (BLOCH). The difference between them is as follows: the former is larger measuring about 40–50 cm. and the latter is smaller, 10–15 cm. in body length. The dorsal fins of the former species are separated, where as those of the latter are connected together. The male has urogeintal papilla and anal fin which indicate a secondary sexual character. In autmn, *Lampetra planeri* (BLOCH) has a separated dorsal fin lacking the secondary sexual character. This condition continues about one month before the next spring of the spawning season and then the both dorsal fins begin to continue together and in the spawning they will grow to be of a typical adult. The adult *Lampetra planeri* has a somwhat degenerated teeth in autumn.

Lampetra fluviatilis minor KUDO et ASADA may become adults before the following spawning season; *Lampetra mitsukurii* HATTA is also an adult before the next spawning season, with two separated dorsal fins, and they resemble so closely that they may be a same species.

OKADA, YAICHIRÔ, and **IKEDA, HYÔJI,** 1937: Statistical Observation, on the Species of the Genus *Tribolodon* in Hokkaidô, Japan and Notes on their Distribution. Zool. Mag., 49 (3), pp. 161–172. (in Japanese, with English resume)

The writers report the statistical observations on the species of the Genus *Tribolodon* of Hokkaidô, Japan, and som notes on their distribution. They record 4 species from Hokkaidô.

1. *Tribolodon hakuensis hakuensis* (GÜNTHER) (*Leuciscus hakuensis*)
2. *T. hakuensis phalacrocorax* J. et F. (*Leuciscus phalacrocorax*)
3. *T. hakuensis ezoe* subsp. nov. (*Leucisus hakuensis*)

SATÔ, SHIN-ICHI, 1937: The Fauna of Akkeshi Bay. VI. Pisces. Jour. Fac. Sci. Hokkaidô Imp. Univ*., 6 (1), pp. 13–33. (in Japanese).

The writer studied the fish around the Akkeshi Marine Biological Station, Akkeshi, Hokkaidô. Three

* Jour. Fac. Sci. Hokkaidô Imp. Univ. = Journal of the Faculty of Science, Hokkaidô Imperial University, published by the Faculty of Science, Hokkaidô Imperial University, Sapporo, Hokkaidô.

species of freshwater fishes among the 99 species which are found in this districts are as follows.

1. *Oncorhynchus nerka.*
2. *O. keta.*
3. *O. gorbuscha.*
4. *O. masou.*
5. *Hucho perryi.*
6. *Salvelinus leucomaenis.*
7. *Osmerus dentex.*
8. *Spirinchus laceolatus.*
9. *Hypomesus japonicus.*
10. *Salangichtys microdon.*
11. *Leuciscus hakonensis.*
12. *Gasterosteus aculeatus aculeatus.*
13. *Pungituis pungituis.*
14. *Hyporhamphus sajori.*
15. *Chaenogobius annlaris annlaris.*

TAMURA, OSAMU, 1937: A Study of *Cottus pollux* GÜNTHER. Suisan Gakkai-hô, 7 (3), pp. 135–148. (in Japanese).

The author made the observations of *Cottus pollux* in the Oshi River, upper stream of the Kuji River, around Daishi Machi, Ibaraki Prefecture during March and December of 1936. He mentioned the individual variations, sex difference in morphological aspects and living habits, food habits and other breeding habits. On the account of the development, he describes the breeding season, eggs and normal development.

YABE, HIROSHI, 1937: Breeding Habits of a Small Cypinoid Fish, *Pseudorasbora parva* T. et SCH. in the Paddy-field., Bot. & Zool., 5 (10), pp. 1860–1868. (in Japanese).

The writer makes an observation of breeding habits of *Pseudorasbora parva* in the paddy field at Fusan, Korea in May of 1936. In this report he mentions the distributing area, spawning place, eggs, protection of eggs after depositing, courtship, biological significance of pearl organs of Cyprinidae.

YAMAMOTO, TAKAHARU, 1937: The Time Required for Hatching the Eggs of Japanese Killifish, *Oryzias latipes* (T. et SCH.), and Dutch-Lion-Head Gold-fish, *Carassius auratus* (LINN.). Bull. Jap. Soc. Sci. Fish., 6 (2), pp. 105–109. (in Japanese).

The author made experiments on the relation between time required for hatching the eggs of Japanese Killifish, and the Dutch-Lion-Head Gold-fish. He used the materials the eggs of Killifish and Gold-fish just after the spawning and kept them at various constant temperatured aquaria. The time required for hatching and the percentage of the hatched fry were observed. To obtain a series of constant temperatures a SENO-TAUTI'S serial incubator was made use of, in which a constant temperature ranging from about 11° to 30°C for the eggs of the Japanese Killifish and 10 constant temperatures ranging from about 12° to 30°C for the eggs of the Dutch-Lion-Head Gold-fish were maintained. The results obtained may be summarized as follows.

1. Water temperatures for the normal development of the eggs range for the Japanese Killifish 18° to 30°C and for the Dutch-Lion-Head Gold-fish 15° to 23°C.

2. The relation between the temperature (0) and the time in day required for hatching (T) may be expressed as given by HIGURASHI and TAUTI by the formula $Te^{a0}=C$, where a and C are constants specific to the eggs of the respective kind. The values of those constants found in the present experiment and those of Q_{10} calculated from them are for the Japanese Killifish a 0.0799 & Q^1_{10} 2.22, and for the Dutch-Lion-Head Gold-fish a 0.0933, C 1.526 and Q_{10} 2.54

YAMAMOTO, TOKI-O, 1937: Literatures of *Aplocheilus latipes*. Zool. Mag., 49, pp. 393–396. (in Japanese).

The author listed up a completed literature concerned to *Aplocheilus latipes* since TEMMINCK and SCHLEGEL described in 1816.

YAMASHITA, HIROZÔ, 1937: Freshwater Fishes of Toyama Prefecture. Toyama Kôtôgakkô Hakubutsu Dôkôkaishi*, 3, pp. 1–11. (in Japanese).

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* Toyama Kôtôgakkô Hakubutsu Dôkôkaishi = Toyama Natural History Magazine published by the Natural History Society of Toyama High School, Toyama.

The writer mentions the following fishes from Toyama Prefecture in this report.

1. *Lampetra planeri.*
2. *Oncorhynchus keta.*
3. *Plecoglossus altivelis.*
4. *Oncorhynchus masou.*
5. *Salmo irideus.*
6. *Salvelinus fontinalis.*
7. *S. malma.*
8. *Hypomesus olidus.*
9. *Parasilurus asotus.*
10. *Liobagrus reini.*
11. *Misgurnus anguillicaudatus.*
12. *Cobitis taenia.*
13. *Rhodeus tabira.*
14. *Rh. longipinnis.*
15. *Sarcocheilichthys variegatus.*
16. *Pseudorasbora parva.*
17. *Leuciscus hakonensis.*
18. *Zacco platypus.*
19. *Phoxinus steindachneri.*
20. *Hemibarbus barbus.*
21. *Carassius carassius.*
22. *Anguilla japonica.*
23. *Oryzias latipes.*
24. *Gasterosteus aucleateus.*
25. *Pygosteus sinensis.*
26. *Cottus pollux.*
27. *C. kazika.*
28. *Tridentiger obscurus.*
29. *Acanthogobius flavimanus.*
30. *Rhinogobius similis.*
31. *R. giurinus.*
32. *Chaenogobius macrognathus.*
33. *Chloea castanea.*
34. *Leucopsarion petersi.*

1938

HASHIMOTO, KENSUKE, 1938: Freshwater Fishes of Yamagata Prefecture. Yamagata-ken Kyoiku,* (574), pp. 22–36. (in Japanese).

The author has described 44 freshwater fishes from Yamagata Prefecture and discussed their distribution. He recognized the demarcated line between the northern and southern parts of Japan at Inubôzaki on the Pacific coast and at the western end of Shimane Prefecture on the Japan Sea coast. In Yamagata Prefecture in the middle of Japan proper, tropical elements are represented by six species while the palaearctic ones number ten species. The existence of large pit organs is easily inferable macroscopically by the slit-like, whitish spots in the skin. The lateral line canal system in the head comprises the four, supra-orbital, infra-orbital, operculo-mandibular and main canals. In the present paper, the author made detailed descriptions of the cranial nerves.

HAYAGURI, ISAO, 1938: Unsymmetry in the number of Eggs and Ovaries in Both Sides of the Body. Yoshokukaishi, 8 (6–7), pp. 66–70. (in Japanese).

The author studies on the unsymmetry of egg numbers and ovaries in both sides of the body in *Oncorhynchus keta* (WALBAUM), *O. masou* BREVOORT, *Salmo irideus* GIBBONS, *Salvelinus fontinalis* (MITCHELL). He concludes that the number of depositing eggs of Salmonidae decreases to the increase of the body weight. The depositing egg number for the unit of body weight is the most in *Salvelinus fontinalis* and *Salmo irideus*, and the least in *Oncorhynchus keta.* The depositing egg number for the fish body weight 100 g is 464.0 in *Salvelinus fontinalis* and 414.8 in *Salmo irideus* and 144.6 in *O. masou* BREVOORT. The unsymmetry of ovaries occurs in *O. masou irideus* and *Salvelinus.*

IKEDA, HYÔJI, 1938: Statistical Observations of the Species of the Genus *Tribolodon* in Japan and some Notes on their Distribution. Sci. Rep. Tôkyô Bunrika Daigaku,** B, 3 (56), pp. 163–192, (in Japanese).

From the statistical point of view, the author distinguished the species of *Tribolodon* into 3 species

* Yamagata-ken Kyôiku = Magazine of Education, Yamagata Prefecture, published by the Yamagata Prefecture Government, Yamagata.

** Sci. Rep. Tôkyô Bunrika Daigaku = Science Report of the Tôkyô University of Education, published by the Science Department of the Tôkyô University of Education, Tôkyô.

indicating the rather different local distribution. On the middle of Honshû including the Kantô region, *Tribolodon hakuensis hakuensis* (G.) is found, and on the slope of the Sea of Japan and northern Honshû of the Pacific coast, *Trid. hakuensis hakuensis*, *T. taczanowskii* (ST.) and *T. hakuensis ezoe* OK. et IK. In Hokkaidô, we have three species as mentioned above, while in the southern part of Japan, only one species *T. hakuensis hakuensis* exists.

IKEDA, HYÔJI, 1938: Freshwater Fish of Miyazaki Prefecture. Hakubutsugaku-Zasshi, 36 (65), pp. 87-90. (in Japanese).

The author made a survey of South Kyûshû during 6-17th, April of 1937. He added new freshwater fish to the preceding collection in this district. He described 24 spp., belonging to 9 families. The species are as follows.

1. *Oncorhynchus macrostomus* (GÜNTHER): Localities are the River Gokase, Kitagata-mure; the River Sakayagawa. 2. *Plecoglossus altivelis* T. et SCH: The River Gokase and many other rivers of this Prefecture. 3. *Parasilurus asotus* (LINN.): The River Ichinose, Shimotajima-mura. 4. *Carassius auratus* (L.): The River Omaru, Takanabe Machi; The River Ichinose, Shimotajima-mura; the River Ishigaki, Hirose-mura. 5. *Pseudogobio esocinus* (T. et SCH,): The River Gokase. 6. *Pungtungia hilgendorfi* (ISHIKAWA): The River Oyodo, Miyakonozyô. 7. *Tribolodon hakuensis hakuensis* (GÜNTHER): The River Gokase and Omaru, Takanabe-machi. 8. *Phoxinus stenidachneri* SAUVAGE: The River Gokase and the River Sakaya. 9. *Zacco platypus* (T. et SCH.): The River Omaru and the River Gokase. The author remarks that the species is allied to *Zacco evolans* JORDAN et EVERMANN from Formosa. 10. *Zacco temmincki* (T. et SCH.): The River Gokase and the Rive Omaru. 11. *Misgurnus anguillocaudatus* (CANTOR): Around Takanabe-machi. 12. *Anguilla japonica* T. et SCH.: The River Gokase, the River Omaru, the River Ishigaki and the River Sakaya. 13. *Anguilla mauritiana* BENNETT: In 1937 Ogawa, Kzuwo discovered this specimen in this prefecture. 14. *Aplocheilus latipes* (T. et SCH.): The Shimotajima-mura; Takanabe-machi; Kuraoka-mura. 15. *Mugil cephalus* LINNAEUS: The River Omaru. 16. *Eleotris oxycephala* T. et SCH.: The River Ichinose, Shimotajima-mura. The author notes that the present species resembles with *E. melanosoma* BLEEKER, distributed near Philippines, South China and Indonesians. 17. *Mogurnda obscura* (T. et SCH.): Near Takanabe-machi. 18. *Luciogobius guttatus* GILL: The River Omura, near Takanabe-chô; the River Sakaya. 19. *Gobius similis* (GILL): The River Omaru, the River Sakaya. 20. *Gobius giurinus* (RUTTER: The River Daimaru. the River Ishizaki. 21. *Gobius tessellata* HERREE: The River Ishizaki. This species was recorded from Philippines, Yakushima, Okinawa Islands but not yet from Honshû, Japan. 22. *Chaenogobius annularis urotaenia* (HILGENDORF): The River Sakaya. 23. *Tridentiger obscurus* (T. et SCH.): The River Gokase, the River Sakaya. 24. *Sicydium japonica* TANAKA: The River Sakaya. The author makes a concluson that the freshwater fish fauna of the present prefecture occupies south elements. Among 24 species, *C. auratus*, *M. anguillicaudatus*, *A. japonica*, *A. mauritiana*, *A. latipes*, *E. oxycephala*, *M. obscura*, *G. similis*, *G. giurinus*, *G. tessellata*, *S. japonica* are distributed in Philippines and the last, Indian peninsula. The northern elements are shown in only 3 species *O. macrostomus* (G). *T. h. hakuensis* (G.). *Ph. steindachneri.*

IKEDA, HYÔJI, 1938: Notes on the *Tribolodon* of Japan. Zool. Mag., 50 (4), pp. 183-184. (in Japanese).

From the statistic observation of 2,600 individuals of Japanese *Tribolodon* the author distinguished 3 species, 3 subspecies and a variety. *T. taczanowski* (STEINDACHNER), *T. hakuensis hakuensis* (GÜNTHER), *T. hakuensis phalacrocorax* (JORDAN et FOWLER), *T. hakuensis ezoe* OKADA et IKEDA, *T. hakuensis punctatus* SAUVAGE, *T*, *hakuensis* var ?, *T. medius* OSHIMA

IKEDA, HYÔJI, 1938: Note on *Gasterosteus aculeatus aculeatus* (L.) with abnormal Number of a Dorsal Spines. Zool. Mag., 50 (8), p. 393. (in Japanese).

G. aculeatus aculeatus with four dorsal spines rarely occurrs in the specimens from Fukui and Gifu Prefectures. The author added a new example found in the fish culture pond of Aisaka, Fujisakamura, Kamikita-gun, Aomori Prefecture. The present form may be included in the Nemuro form advocated by IKEDA in 1933.

KATAOKA, NAOTAKA, 1938: On the Rearing of *Plecoglossus altivelis* T. et SCH. in the Pond (Preliminary note). Bull. Jap. Soc. Sci. Fish., 7 (2), pp. 96–100. (in Japanese).

The author makes an experiment to rear the larva hatching out of artificially fertilized eggs in a coop kept on the pond and or in a concrete pool at the Nakayama Culture Pond, Nagano-mura, Kawabe-gun, Hyôgo Prefecture. From his experiment, he gained a good result. To keep the water temperature at 16–18°c is quite needful to grow the fry in the pond. Micro-organisms, phyto and zooplankton and especially water flea raised in the pool are indispensable for their food to rear the fry. After the fry had grown to some extent, they were fed with artificial food, such as fish meal etc., and fair-sized, full-grown fish were obtained.

KATAYAMA, MASAO, 1938: Interbreeding of *Macropodus chinensis* and *Macropodus viridiauratus*. Suisan Ken-kyûshi, 33 (1), pp. 34–39. (in Japanese).

He has succeeded in the experiments for the interbreeding of *Macropodus chinensis* and *Macropodus viridiauratus*. The hybrids between the male *Macropodus viridiauratus* and the female *Macropodus chinensis* exhibit the character of the denticulated lower margin of preoccular bone resembled that of the female while the patterns resembled those of the male. The caudal character indicates an intermediate form.

KOBAYASHI, HISAO, 1938: Comparative Studies on the Scales of Japanese Cyprinids (IV). Bot. & Zool., 6 (7), pp. 1229–1236. (in Japanese).

The writer describes the scale of following species. *Pseudogobio esocinus* (T. et SCH.), *Belligobio eristigma* JORDAN et HUBBS, *Hemibarbus barbus* (T. et SCH.), *Biwia zezera* (ISHIKAWA), *Pseudorasbora parva* (T. et SCH.), *Pseudorasbora parva pumila* MIYADI, *Tribolodon hakuensis* (GÜNTHER). In this paper, he did not make a conclusion about the general idea of scales of Cyprinidae.

KOBAYASHI, HISAO, 1938: Comparative Studies on the Scales of Japanese Cyprinids (V). Bot. & Zool., 6 (9), pp. 1498–1510. (in Japanese).

In the 5th report, he mentions the scales of following species. *Phoxinus staindachneri*, *Ph. steindachneri* morpha *yamamotis*, *Zacco platypus*, *Z. temmincki*, *Ischikauia steenackeri*, *Opsariichthys uncirostris*, *Hemigrammocypris rasborella*, *Carassius carassius*, *Cyprinus carpio*. From his observations of these species, he concludes that the fishes of Acheilongnathinae have a Acheilongnathinae type and are easily distinguishable in genera and species by the scale constitution. Gobioninae fish has the Gobioninae type and has a convergence in the scale constitution. The scale constitution of *Gnathopogon elongatus elongatus* (T. et SCH.), and *G. el. suwae* J. et HUB. is quite similar. The group of all the Leuciscinae has the Leuciscinae type of the scale except Hemibarbus and has a divergence in the scale constitution. *Opsariichthys uncirostris* included under the Leuciscinae, has only Gobioninae type of scale constitution. *Phoxinus steindachneri* SAUVAGE and *P. st. yamamotis* has quite same a scale constitution. *Pseudorasbora parva* and *P. p. pumila* have the same scale. Gold-fish and Iron fish have a similar scale constitution.

KOBAYASHI, HISAO, 1938: On the *Plecoglossus altivelis* (II). Suisan Ken-kyûshi, 33 (6), pp. 265–284. (in Japanese).

The writer describes general ideas on this fish. The topics are mostly as follows: 1. natural and artificial foods 2. Spawning period. 3. Life of "Ayu". 4. Pond culture. 5. Protection of natural "Ayu". 6. Fishing of "Ayu". 7. Taste and Cooking.

KOBAYASHI, HISAO, 1938: On the *Plecoglossus altivelis* (III), Suisan Ken-kyûshi, 33 (7), pp. 320–341. (in Japanese).

In this chapter, he describes the diseases of "Ayu", including ectoparasitic and endparasitic.

KOKUBO, SEIJI, 1938: Notes on the Herring of Ozamenuma, Aomori Prefecture. Zool. Mag., 50 (4), pp. 185–186. (in Japanese).

Ozame Herring migrates regularly every year from the Pacific to Ozamenuma at Aomori Prefecture. It comes up to the river at the beginning of December and spawns during the end of March. The eggs are fertilized in brackish water with a specific gravity of 1.008, and the hatched embryo developed into a young of 6 cm. length by June of the same year. The young go down to the Pacific and return to Ozamenuma when they are mature. The materials which the author examined this year, were 25–35cm. in body length and from 2 to 8 years old, 3–4 year old ones were especially abundant. The outer features are closely allied to that of Hinuma Herring. The head is small, lateral line scales more numerous. The body is rather larger then the other specimens of the same year. The body is heavier then the normal specimens of the same age. Specimens with the same characters are found at "Tashiroshima", Miyagi Prefecture and Hemima, Ibaraki Prefecture. From these observations, we shall recognize them as a peculiar race of herring, but there is a question whether each should be considered as an independent group, or whether they have some connection in any rate. Anyhow, the present race is quite different from the race of Hokkaidô.

KUBO, IZUO, 1938: Preliminary Notes on the Stock of the Anadromous Dog Salmon, *Oncorhynchus keta* (WALBAUM), 1. On the Catch from the Miomote River. Bull. Jap. Soc. Scie. Fish., 6 (5), pp. 262–265, (in Japanese).

He reports that he had an opportunity to observe the anadromous salmon of the River Miomoto, Murakami-chô, Niigata Prefecture and found "*Gira*" a different stock of salmon (appeared at the end of fisheries season) together with "*Buchi*" (this is a common salmon). He also makes a comparison of two different stocks by morphologically. Of 192 specimens obtained from the River Miomote, during November 20th and 28th, 1936, 170 were "Common" Dog salmon, ranging from 2 to 6 years in age. The 3 year and 4 year salmon are prominent, the latter representing more than the half of the catch. The remaining 22 specimens are called "silvery" and may be distinguished from the "common" for the silver color of the body. But paucity of the material dose not enable one to drew up strict distinctions between the "common" and "silvery" so far as the measurements of body length, body depth, body weight, ratio of body depth to body length and number of scales go.

KUBO, IZUO, 1938: The Capture of Salmon in the Miomote River, Niigata Prefecture in Relation to Some Meteological Factors: Bull. Jap. Soc. Scie. Fish., 7 (2), pp. 101–104. (in Japanese).

The author tries to find out the relation between the Salmon catching in the Miomote River, Niigata Prefecture and some meteological factors during 19 years (1919 and 1937). In conclusion he has not found any relation between the capture and the air temperature or the amount of rain, although a singnificant positive correlation was observed to occur between the catch and the amount of snow in the fishing season (November – December). The catch is influenced by the conditions of wind; north wind (NNE-NNW) and west (WSW-WNW) at Wazima, Niigata, Akita and Aikawa is ineffective to the catch. On the contrary, east wind at Aikawa and Akita and south wind at Wazima and Niigata throw a good condition to the catch. The velocity of wind at Niigata is very effective on catch, strong wind being unfavourable for the catch.

KUBO, IZUO, 1938: Study on the Stock of the Anadromous Dog Salmon, *Oncorhynchus keta* (WALBAUM). II. Biometric Study of "Common" and "Silvery" Dog Salmon obtained from the Miomote River. Bull. Jap. Soc. Scie. Fish., 7 (5), pp. 271–275.

The author finds out that the two different stocks of dog salmon, viz., "Common" and "Silvery" at the River Miomote, Niigata Prefecture. In this second report, he reported that he finds out 326 "common" and 179 "silvery" specimens ranging from 2 to 5 years old in the whole group. They are easily differentiated samples distinct in such characters as thickness of scale, head length, length from snout to posterior margin of base of dorsal-fin and depth of body on anterior margin of base of dorsal-fin.

KOSHIDA, SYUHÔ, 1938: Colour Phase of Carp in Niigata Prefecture. Nogyô oyobi Engei*, 13, pp. 173-178; 13 (2), pp. 134-138; 13(3), pp. 114-122; 13 (4) pp. 145-152, (in Japanese).

The famous colour phase of *Cyprinus carpio* called "Irogoi" is known from olden times (about 1781) when the fish were cultivated in the ponds of Nijusongo Koshi-gun, Niigata Prefecture. In 1873, the "Irogoi" was in most fashion and the "Sarasa" and "Kintsuri" were very expensive at that time. He has mentioned the general aspectes of the carp in the following topics. Colour, the races, and feeding in the 1st part, in the 2nd part, he treated feeding of adult fish, hatching, feeding of young, feeding of 2-3 years old fith, feeding of the adult, and selection. In the 3rd part, he mentioned the colour changes of the young and interbreeding. In the final part, he made remarks on the price and general conclusions for feeding.

KURONUMA, KATSUZÔ, 1938: Notes on the Form of Eggs in Japanese Rhodeine Fishes of the Genus *Acheilognathus*. Suisan Ken-kyûshi, 35 (9), pp. 234-235. (in Japanese).

Generally the size and form of fish eggs are definite according to the species, though often indefinite in the resembling species of external form. The writer observed the egg-form of *Acheilognathus tabira* and *Acheilognathus cyanostigma* and found it different in the ratio between its diameter and length. The eggs, remained in the ovipositor, were also measured in two females of each species.

KUROKI, EIITI, 1938: Carps (*Cyprinus carpio* L.) and Crucian Carp (*Carassius auratus* L.) fromt he Lakes of Aoki, Nakatuna and Kizaki, Nagano Prefecture. Bull. Jap. Soc. Scie. Fish., 8 (2), pp. 69-72. (in Japanese)

The writer tried a survey of carps and crucian carp of the three lakes, Aoki, Nakatuna and Kizaki for the age-composition, body'length, and others. All the carps experimented in were two yeays old and for their growth rate, Lake Kizaki, being of eutrophyc type, was superior to the other two. The age composition of crucian carps was normal in Lake Kizaki, but abnormal in the other lakes. Such abnormality seems to have bearings on the variation in catch and in the number of snowy days during the year the when each year class was hatched. Dimensions of the body were poor in Lake Nakatuna, while the quality indicator was low in the oligotrophic Lake Aoki.

MATSUI, ISAO, 1938: Relation between the Development of the Alimentary Canal and Food Habits. Suisan Ken-kyûshi, 33 (10), pp. 457-469, (in Japanese with English Resume).

The author has treated 95 fishes ranging from young of 5 mm. to 180 mm. body length. He divided the digestive system of "Ayu" into a dental, alimentary canal, accessory organs and a tongue fold systems. The dental system consists of 7 parts, glossopharyngeal, pharygeal, palatine, vomerine, pterygoid, incisor and teeth-plates. The dental system develops evenly in the fish of 40 mm. in length (author called the teeth plates "Banjosi"), and in 60-70 mm. body length, the dental system is fully developed and then the incisors begin to degenerate. The fish of 65 mm. to 80 mm. in length usually ascend to the river and in this stage the dental system on the maxillay bones is set up and may be called "adult type". The tongue-fold begins to form and develops very fast over the greater parts of the buccal cavity when the fish reaches 60-75 mm. in body length. The food consists of zooplankton in the early stage but of benthos when the fish gose up into the river. It is a very interesting fact that the differentiation of the dental system and the tongue-gold just correlates to the change of natural foods.

As to the alimentary canal, the fish of about 45 mm. in length has still a straight canal, without differentiation of stomach. But when the fish grows to 55 mm. in body length, the anterior portion of the alimentary canal changes into a curved shape and takes the adult form of the stomach. In the fish of 70 mm.-80 mm. in length, the pyloric coecum get an adult from consisting of 160 filaments. It is evident that there exists very close relation of the alimentary system.

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* Nogyo oyobi Engei = Monthly Magazine of Agriculture and Horticulture, published by Yôkendô Co. Ltd., Tôkyô.

OKA, TOHRU, 1938: A Guanophora of Male Fin Margin of *Aplocheilus latipes* as a Secondary Sexual Character. Zool. Mag., 50 (4), pp. 173–174. (in Japanese).

The writer observes the Guanophores and Iridophores along the margin of all fins of the male *Aplocheilus.* These may appear prominently on the anal and caudal fins, and less on the caudal fin. On the pectoral and ventral fins Guanophores much less. In the female, Guanophores not exist. These sexal characters can be seen in the water below the wate temperature of 10°C and may appear above 25°C water temperature.

OKADA, YAICHIRÔ, 1938: A Catalogue of Vertebrates of Japan. Maruzen Company, Ltd. Tokyô, pp. 1–420.

The author makes a complete list of vertebrates of Japan. Of those, 101 species of freshwater fishes are listed.

OKADA, YAICHIRÔ, and **SEIISHI, REIZO,** 1938: Morphological and Ecological Studies of the larvae and youngs of Freshwater Fishes in Japan. (10) *Rhinogobius similis* GILL. Suisan Kenkyûshi, 33 (2), pp. 94–98. (in Japanese).

The writers mention the life cycle of eggs, larval stages, youngs, and the food in each stage of the development of *Rhinogobius similis.*

OKADA, YAICHIRÔ, and **SEIICHI, REIZO,** 1938: Studies on the Early Life History of 9 species of Freshwater Fishes of Japan. Bull. Bio. Soc. Jap., 8 (15), pp. 223–252.

The writres wishes to know the life history of the nine freshwater fishes which are important for fisheries. The species are as follows. *Tribolodon hakonensis* (GÜNTHER), *Zacco platypus* T. et SCH., *Pseudorasbora parva* T. et Sch., *Acheilognathus lanceolatus* (T. et SCH.), *Cobitis biwae* JORDAN et SNYDER, *Misgurnus anguillicaudatus* (CANTOR), *Lefua echigonia* JORDAN et RICHARDSON, *Pseudobagrus aurantiacus* (T. et SCH.), *Rhinogobius similis* GILL., of all these fishes, eggs, larvae, breeding, food habits are observed and described in this report.

OKANO, KAN, 1938: Freshwater Fishes from the Vicinity of Hamamatsu City. Hakubutsugaku Zasshi, 36 (64), pp. 69–72, (in Japanese).

The author listed the freshwater fishes obtained in the Tenryû River and Lake Sanaru, Shizuoka Prefecture. The list contains 45 species of 20 families. The specimens are preserved in the Biological Laboratory of Hamamatsu First Middle School.

ÔSHIMA, MASAMITSU, 1938: Reviews of the Charrs found in the Japanese Waters, with Description of One New Species. Bot. & Zool., 6 (9), pp. 1491–1497. (in Japanese).

The writer discussed the scientific name of Japanese Charrs from historical point of view. In 1856, BREVOORT named the Japanese Charrs as *Salvelinus leucomaenis* (PALLAS) from the specimen obtained by PERRY at Hakodate, Hokkaidô. In 1876, HILGENDORF got the specimen from Nikkô and named it for a new species, *Salmo pulvius* HILGENDORF. In 1897, Dr. ISHIKAWA, CHIYOMATSU, identified the specimens from Shirubishi, Hokkaidô, as *Salmo leucomaenis* and the specimens from Aomori, Kiso, Chichibu, Kaga, the River Kamo as *Salmo pluvius* HILGENDORF. In 1902, JORDAN and SNYDER described the 3 species *Salvelinus pluvius* (HILGENDORF), *Salvelinus imbrius* J. et McGR., *Sal. leucomaenis* (PALLAS). From these descriptions, Japanese charrs were distinguished into 5 species by Japanese ichthylogist but Dr. TANAKA, SHIGEO took all of them into one species, *Salvelinus malma.* The present author has quite different an opinion that the Japanese Charrs must be included into two species, *S. malma* which is mostly distributed in Karafuto and *S. leucomaenis* (PALLAS) distributed in Karafuto and Kamchatka.

ÔSHIMA, MASAMITSU, 1938: A Review of the Charrs found in the Japanese Water, with Description of one New Species (II). Bot. & Zool., 6 (10), pp. 1668–1674.

This is his second report of Japanese Charrs *Salvelinus malma* (WALBAUM), *Salvelinus leucomaenis* (PALLAS) and a new species *Salvelinus miyabei* n. sp. He has some question in between the *S. malma* at Karafuto and that of the River Rubetsu, Etorofu Island, Kurile Islands. He identified the specimens from the Rivers of Hokkaidô to be *Salvelinus leucomaenis* (PALLAS). In Lake Hikaribetsu, Tokachi Provience, Hokkaidô, there was found a landrocked trout which has red spots on the body sides. It is quite different a point from *S. leucomaenis*. The author observed this specimen and named *S. miyabei*, as a new species.

ÔSHIMA, MASAMITSU, 1938: A Review of the Charrs found in the Japanese Waters, with Description of One new Species. (III). Bot. & Zool., 6 (11), pp. 1821-1826. (in Japanese).

The three species *Salvelinus pluvius* HILGENDORF, *Salv. latus* ÔTA and *Salv. imbrius* JOR. et MC GREGOR and *Salv. leucomaenis* (PALLAS) are distributed in the Rivers Tanjô, Hida Province, Ozenuma, Gumma Prefecture, in the upper streams of the Arakawa River in Yamagata Prefecture, the River Abukuma; Nobechi, Aomori Prefecture. *S. pluvius* (HILGENDORF) is distributed in Nikkô, the River Shima, the River Katabina and the River Kinu, Gunma Prefecture, the River Arakawa, Saitama Prefecture, the River Yashû, and Kusano around Lake Biwa and the River Yoshino, Nara Prefecture. This species is quite separable from *S. leucomaenis* by the red spots for which it is called a "Red spotted Charr" by JORDAN.

SATÔ, ROKUZI, 1938: On the Migratory Speed of Salmon and the Stock of Red Salmon estimated from the Tagging Experiments in Northern North Pacific. Bull. Jap. Soc. Sci. Fish., 7 (1), pp. 21-23.

The writer concludes as follows: 1. In the tagging experiment, the relation between the distance traversed (y) and the number of days (x) taken by a recaptured fish is formulated as $y=ax$ (a being the speed of the fish). The speed of salmon calculated statistically, applying (1), with 293 recaptured fishes of the tagging experiments in northern North Pacific is 12.3 sea miles a day. 2. The stock (s) of red salmon may be estimated by the formula: $Y : X = S : Z$, where Y is the number of tagged fishes, X, the number of recaptured fishes and Z, the total catch of the fish. The stock of the fish migrating in northern North Pacific estimated from (2), is 94.7×10^6 individuals in 1936, and so the catching limit of the fish in that year, if the return-percentage of red salmon in Alaska is applied, becomes 35.0×10^6 fishes.

SHINKAWA, SHÔJIRÔ, 1938: Medaka-kô (Investigation Report of the local Names of *Aplocheilus latipes*.) published by the author, Tôkyô, June 15, 1938. pp. 1-12. (in Japanese).

This report covers a very wide investigation of the local names of common *Aplocheilus latipes* from all districts of Japan. The present species is very common and is rather popular known to all people, caught for food and aquarium.

SUISANKYOKU, NÔRINSYÔ, (Fisheries Bureau, Ministry of Agriculture and Forestry) 1938: An Experiment of an Artificial Hatching-out Method of *Sarcocheilichthys variegatus*. pp. 1-12. (in Japanese).

The authorities make a new apparatus of Artificial Hatching-out Method by utilizing the natural spawning habit. In natural this fish always spawns into the gill chamber of freshwater-bivalve througt an inhalent canal. The egg and embryo develop in the gill chamber and get out through the exhalent canal into the water. From this idea, the authorities consider to make a new apparatus for the convenience of spawning this into a series of bivalves to fix a line by a cement plate and when the fish spawns into a bivalve, to such one by one artificially into another apparatus to make it hatch out.

TOYAMA SUISAN KAI, 1938: Ecological Studies of *Gnathopogon elongatus* and its Breeding I. Suisan Ken-kyûshi, 35 (6), pp. 142-147. (in Japanese).

The writer Mr. YABE, one of the authorities of the Toyama Suisan Kai chiefly studied the ecology of *Gnathopogon elongatus* at the River Shôgawa, Toyama Prefecture, in 1936. The sexual characters in the breeding period, the sex-ratio, sexual maturity and the size of fish, egg numbers to deposit, development, and food habits are recorded in this report.

TOYAMA SUISAN KAI, 1938: Ecological Studies of *Gnathopogon elongatus* and its Breeding II. Suisan Ken-kyûshi, 35 (7), pp. 160-165. (in Japanese).

In this second report, the writer mentions the lower limit of the water temperature for the suspension of food searching. He also mentions the culture, concerning the rate of growth, the amount of food, mixture rearing.

YAMADA, TOMOHARU, 1938: On the Malformation *Plecoglossus altivelis* T. et SCH. from the Yoichi River, Hokkaidô. Bull. Jap. Soc. Scie. Fish., 8 (6), pp. 355-356. (in Japanese)

The deformed salmon and trout were often reported by many previous investigators. It is rather a rare case in *Plecoglossus altivelis* which happened at the Yoichi River, Hokkaidô in the summer of 1939. Five deformed specimens of the sexually mature were obtained from the River Yoichi in the summer of 1939.

YAMAMOTO, KÔJI, 1938: The Time required for Hatching of the Eggs of the Japanese Killifish, *Oryzias latipes* (T. et SCH.), and the Dutch-Lion-Head Gold-fish, *Carassius auratus* (L.), Bull. Jap. Soc. Scie. Fish., 6 (2), pp. 105-109. (in Japanese).

The author makes some experiments of incubation periods of two typical Japanese freshwater fishes, *Oryzias latipes* and *Carassius auratus*. He keeps two species at various constant temperatures. He observes the time required for hatching and the percentage of the hacthed fry. The equipment which was used for this experiment is a SENO-TAUCHI serial incubator which has 6 constantures ranging from about 11°to 30°C for the Japanese killifish and ten constant temperatures ranging from about 12° to 31°C, for the of the Dutch-Lion-Head Gold-fish were maintained. He concluded from the experiments.

1). Water temperatures for normal development of the eggs range for the Japanese killifish 18°-30°C for the Dutch-Lion-Head Gold-fish 15°-23°C. 2). The relation between the temperature (θ) and the time in days required for hatching (T) may be mentioned by HIGURASHI and TAUTI by the formula $Te^{a\theta}=C$, where a and C are constants specific to the eggs of the respective kind. The values of these constants found in the present experiment and those of Q_{10} calculated from them are for the Japanese killifish a 0.0799, C 1.923 and Q_{10} 2.22 for the Dutch-Lion-Head Gold-fish a 0.933, C 1.526 and Q_{10} 2.54

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IKEDA, HYÔJI, 1939: Fauna of Yamanaka Lake, Yamanashi Prefecture (XVI). -- Notes on *Phoxinus steindachneri* SAUVAGE and Outlines of Freshwater Fishes in Yamanaka Lake. Hakubutsugaku Zasshi, 37, 67, pp. 70-75, (in Japanese).

He has observed a large number of specimens of *Phoxinus steindachneri* from Yamanaka Lake and found sexual differences in the genital constructions and the appearance of pearl organs. D.S. JORDAN and C. L. HUBBS established a new species of *Moroco yamamoto*'s in 1925 but the author took this species as a synonym of *Phoxinus steindachneri*. At the end of his paper, he has added a list of fishes of Yamanaka Lake, including 15 species belonging to 5 families as follows.

1. *Oncorhynchus nerka.*
2. *O. masou.*
3. *Hypomesus olidus.*
4. *Plecoglossus altivelis.*
5. *Parasilurus asotus.*
6. *Cyprinus carpio.*
7. *Carassius auratus.*
8. *Gnathopogon elongatus.*
9. *Pseudorasbora parva.*
10. *Sarcocheilichthys variegatus.*
11. *Tribolodon hakuensis hakuensis.*
12. *Phoxinus steindachneri.*

13. *Misgurnus anguillicaudatus.*
14. *Cobitis biwae.*
15. *Lefua echigonia.*
16. *Anguilla japonica.*

IKEDA, HYÔJI, 1939: Some Suggestive Notes on the Fauna of Freshwater Fishes in the Northern Parts of Japan. Bull. Biogeo. Soc. Jap.* 9, 4, pp. 85–90. (in Japanese).

From the collection of freshwater fishes in the northern part of Japan, the author suggested one line in this region. In the slope of the Sea of Japan this line coincides with the administrative boundary of Aomori Prefecture and Akita Prefecture, and in the Pacific slope it runs between Gonoe River and Mabeti River. This line seems to the northern boundary of some fishes which are familiar to us in Japan. The faunal area of freshwater fishes of Aomori Prefecture, which is bounded by BLACKISTON's Line and his proposed line, is very scant and simple as compared with those of the neighbouring regions. Such a faunal scarcity seen in Aomori Prefecture seems to be a attributable to the fact that the northern forms become scarce more rapidly than the southern forms at this region, and the occurrence of the former are not proportional to that of the latter forms.

KATAYAMA, MASAO, 1939: Heredity in Fishes. Suisan Ken-kyûshi. Vol. 34, No. 7–12, pp. 222–225, pp. 348–352, pp. 372–381. (in Japanese).

During the investigation on the interbreeding of *Macropodus*, the author summarized the general ideas on this subject. He has mentioned the cytological studies and the interbreeding experiments.

KATAOKA, NAOMASA, 1939: On the Complete Rearing of "Ayu" *Plecoglossus altivelis* T. et SCH., Bull. Jap. Soc. Scie. Fish., 8 (5), pp. 267–279. (in Japanese).

Since 1929, the author has continued the experiments for the artificial rearing of "Ayu" *Plecoglossus altivelis* in the pond and in 1936, he succeeded finally in the experiment. He mentioned the general plan of his experiments in the following topics: The Development of Egg; Experimental Installations; Steps in Breeding.

KOBAYASHI, HISAO, 1939: Notes on the Arrangement of Scales on Eels. Suisan Ken-kyûshi, 34 (5), pp. 1–2. (in Japanese).

He has explained the mosaic patterns on the skin for the scale arrangement of eels. Compared with the scales of the Cyprinid fishes, the present species has different scale construction and orientation.

KUBO, IZUO, 1939: Study on the Stock of the Anadromous Dog salmon *Oncorhynchus keta* (W.) II. Biometric Study of "common" and "silvery" Dog Salmon obtained from the Miomote River. Bull. Jap. Soc. Scie. Fish. 7 (5), pp. 271–275. (in Japanese).

Two different stocks of dog salmon, Viz., "common" and "silvery" were preliminarily reported by this author. To distinguish between them, Chi-square tests were done on the following items: thickness of scale, head length, length from snout to posterior margin of base of dorsal fin, depth of body on anterior margin of base of anal fin, length of caudal peduncle, depth of caudal peduncle and total length except head length, with the results given in this paper. 326 "common" and 179 "silvery" specimens ranging from 2 to 5 years old were obtained from the same river during a period from December 14th to 21th inclusive, 1937. But female specimens of four year olds only (102 in common 117 in silvery) were used for the purpose, because the material of other age classes were too scarce. The results of Chi-square test applied to the data pointed to the conclusion that the two groups are really differentiated samples distinct in such characters as thickness of scale, head length, length from snout to posterior margin of base of dorsal fin and depth of body on anterior margin of base of dorsal fin.

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* Bull. Biogeo. Soc. Jap. = Bulletin of Biogeographical Society of Japan, published by the Biogeographical Society of Japan, Tôkyô.

KUROKI, EITI, 1939: Carp and Crucian Carp from the Lakes of Aoki, Nakatuna and Kizaki, Nagano Prefecture. Bull. Jap. Soc. Scie. Fish., 8 (2), pp. 69–72. (in Japanese).

The author makes an investigation on the age-composition, body length weight and depth, and the quality indicator $1000\ w/l^3$, of carp and crucian carp from the three lakes mentioned above in the title. All the carp experimented on are two years old and in their growth rate, Lake Kizaki, being of a eutrophye type, was superior to the other two. The age composition of crucian carp was normal in Lake Kizaki, but abnormal in the other lakes. Such abnormality seems to have bearings on the variation of the number and catch on snowy days during the year when each year class was hatched. The dimention of the body was poor in Lake Nakatuna, while the quality indicator was low in the oligotrophyc lake, Aoki.

MAKINO, SAJIRÔ, 1939: The Chromosome of the Carp, *Cyprinus carpio*, including those of Some related Species of Cyprinidae for Comparison. Cytologia, 9 (4), pp. 430–440.

He has studied she chromosomes of four Japanese freshwater and marine fishes. In *Misgurnus anguillicaudatus* (CANTOR), the spermatogonium contains 52 well defined chromosomes which are all telomitic rod-shaped. The general morphological appearance of the chromosome complex represents nothing difficult from that common to teleosts and bears much resemblance to that of gasterosteids and of poeciliids. In *Oncorhynchus keta* (WALBAUM), the diploid number of chromosomes are numbered 74. The diploid complement contsists of various kinds of telometic chromosomes. The chromosome number is in disagreement with that was given by PROKOFIEVA (1934, Cytologia 5, p, 498), but the chromosome complex apparently resemble to one another.

NAKAMURA, MORIZUMI, 1939: Spreading of Ophicephalid Fishes in the Inland Waters of Japan. Suisan Ken-kyûshi, 34 (11), 333–337. (in Japanese).

The writer makes a record of the transplantation of the Ophicephalid Fishes into Japan. Two species *Channa argus* (CANTOR), *Channa maculata* (LACÉPÈDE) are introduced from Formosa and Korea. He said that the *Channa argus* was introduced from Korea into Koriyama of Japan 1923–1924. The second species *Channa maculata* was introduced from Formosa into Sakai City of Japan in 1906. Both species are now spreading widely in Japan.

NIWA, HISASHI, 1939: Characters of *Cobitis delicata* NIWA, and its Distribution and Local Variations. Zool. Mag., 51 (2), pp. 97–98. (in Japanese).

The writer makes a lecture on this fish at the 14th Zoological Conference of Japan at Ôsaka. This fish is living in the middle of current rivers. This looks like *Cobitis biwae* but differs from it in the following characters. 1. Upper and lower jaws very thick, forming semi-circle in outline. 2. Labial barbels short, nearly equal with eye diameter. 3. Myomeres 21–23 between the pectoral and ventral fins. 4. Head short, trunk elongated, caudal short. 5. Body, slender and delicate. 6. Eyes, very small. 7. The origin of dorsal and ventral fins begins far posterior from the middle. 8. Lamina circularis not exist. This fish is distributed in Japan, in the River Kiso, a branch of Kiso River, the River Hida; the River Nagara; the River Kuzuryû, the River Shogawa, and the River Zintsû.

OKADA, SHUN and **SAKURAI, MOTOHIRO,** 1939: Distribution and Ecology of *Plecoglossus altivelis* in Hokkaidô. J. J. L. 9 (3), pp. 137–142. (in Japanese).

Plecoglossus altivelis is not originally distributed in Hokkaidô. In the beginning of the Meiji Era, that fish was transplanted into a river of Toshima from Honshû. The author records about the fish from 56 rivers of Hokkaidô. The northern limit of this fish distribution is Volcanic Bay on the Pacific coast and River Hikaribetsu is also the northern limit on the coast of Japan Sea. The ascending period of the fish in Hokkaidô is already passed even on June 10th. The youngs of the first ascending measure 5.5 cm. The water temperature is 13°C in average. The spawning period is somewhat different with rivers, starting from the end of August to the beginning of October.

OKADA, SHUN, 1939: Ecological Note on the Silver Salmon *Oncorhynchus kisutch* (WALBAUM) in the

North Kurile. Zool. Mag., 51 (4), pp. 207–215. (in Japanese).

The writer reports the ecology of the Silver Salmon in the northern Kurile Islands of Japan. Most of them ascend the rivers of Kamtchatka, not entering the rivers of the northern Kurile Islands. In 1937 and 1938, the writer made some ecological study of the fish, basing on several specimens including some young and adults from the Bettobu River in Shimshir Island. He concludes as follows. The young collected from the river are 19 in number, and the 2 and 3 year old young, migrating to the sea, each has a remarkable mark on the dorsal fin, showing the blackened antero-dorsal part. The one year old young lacks the mark and presumably does not migrate within a year. The migration occurs probably in the period from July to August. The females entering the river from the end of August to the middle of September spawn the eggs perhaps in the upstreams of Lake Bettobu in October. 16 specimens are consisting of 2 groups, 3 and 4 year old individuals were collected by themselves from the Bettobu River. Both of them have spent one winter in the sea after leaving the freshwaters. And they dwell in the freshwaters at young stages for one year or, sometimes, for 2 years.

YAMAMOTO, TOKI-O, 1939: Mechanism of Membrane Elevation in the Egg of *Oryzias latipes* at the Time of Fertilization. Proc. Imp. Acad. Tôkyô, 15, pp. 272–274.

In general, the fertilized egg of teleost has the egg membrane or the chorion which is tough and elastic. The unfertilized egg is so closely surrounded by the chorion that there exists a perivitelline space. Upon fertilization the chorion is very soft and gradually becomes hard. As to the mechanism of membrane elevation, it has merely been stated that water penetrates from the outer medium by osmotic relation. With these facts studied by many authorities, he wants to make some experiments for the mechanism of membrane elevation to ascertain the properties cf the chorion and the perivitelline fluid.

1940

AMEMIYA, IKUSAKU and **HIYAMA, YOSHIO,** 1940: Spawning and Age of *Hypomesus olidus* (PALLAS). Suisan Kaihô, 8 (1), pp. 45–62. (in Japanese).

The authors made researches regarding the spawning age, spawning times, the growth rate and age, and life span of *Hypomesus olidus* collected from Kasumigaura. They have summarized as follows: 1). Distinguished the circuli on the scale with broad and narrow zones. The broader zone is formed during summer and the narrower zone in winter. 2). Determine the age by the number of zones. 3). The present fish spawn the next year after hatching out. About 1/4 of the whole remain in the second year and spawn again. After they pass the summer of the second year about 1/5 of the whole remain. The very few remaining spawn again the third summer. 4). The specimens from Kasumigaura grow up to 8 cm. in one year and about 9–10 cm. in two years. 5). Males are more numerous than females. 6). Female has 2500 eggs at the first spawning period.

IKEDA, HYÔJI, 1940: Fishes obtained from Hot-springs. Bot. & Zool., 8 (2), pp. 409–413.

The writer reports the following fishes which are described from many hot springs in Japan.

Species	*water temperature*
Carassius auratus	26–38.52C.
Cyprinus carpio	26–37°C.
Phoxinus steindachneri	34.5°C.
Misgurnus anguillicaudatus	26–37°C.
Aplocheilus latipes	26°–38.5°C
Pseudogobio esocinus	33°-34.5°C.
Tribolodon hakuensis hakuensis	29°–34.5°C.
Cobitis biwae	29–32°C.
Mogurnda obscura	29°–32°C.
Gobius giurinus	33°–34.8°C.

KATAYAMA, MASAO, 1940: A Catalogue of Fishes of Toyama Bay, Toyama Prefecture. Toyama Hakubutsugaku Kaishi, Vol. 3. (in Japanese).

The author listed 411 species of marine fishes in Toyama Bay. One of these is a kind of freshwater fish, *Leuciscus hakuensis* GÜNTHER, found in Toyama Bay.

KATAYAMA, MASAO, 1940: Notes on the female *Chaenogobius annularis annularis* with nuptial Colours. Bot. & Zool. Vol. 8, No. 4, pp. 83-86. (in Japanese).

The present species is broadly distributed from Hokkaidô to Kyûshû and inhabits turbid river mouths, ponds, and swamps. By the spawning season, the female is provided with a nuptial colour. It appears mostly from April to June. During this season, the female may be blackish on the body and has 7 dark cross bands on the sides. The yellow color increases on the abdomen. The head blackish and the lower jaw and pharyngeal portion entirely black. The 1st and 2nd dorsal and anal fins are black.

KOBAYASHI, HISAO, 1940: Speciality of the Eel Scale--the Existence of Transverse Commissure of Radii. Bot. & Zool. 8 (4). pp. 79-80. (in Japanese).

The author discovered the transverse commissure of the radii of loaches which were not yet described by previous authors. He has advocated the peculiar transverse connection to call "Transverse commissure of radii" found only in *Misgurnus* of Misgurniidae.

KUDÔ, SHIGEMI, 1940: Notes on *Carassius auratus* from Hachirôko, Akita Prefecture. Bot. & Zool. 8 (2), 451-454. (in Japanese).

There are three races called "Kinbuna", "Ginbuna" and "Matsukawabuna" in Hachirôko, Akita Prefecture. "Kinbuna" shows a golden colour with slender head and lower body height than the silver colour phase. "Ginbuna" shows a silver colour and is concave on the outer line of the head. But from the observations of many materials, these differences many be considered to be variations of the same species. Variations of caudal fins, pectoral fins, ventral fins, dorsal fins, and anal fins, show nearly the same results as were found by Dr. K. MATSUI. The sex ratio between January 1 and 20, females 629 and males 879 namely ♀ 100: ♂ 141.

KUROKI, EIICHI, 1940: A Study on the Appearance of Scale of Brook Trout, *Salvelinus fontinalis* (MITCHILL). Bull. Jap. Soc. Scie. Fish., 9 (3), pp. 111-114. (in Japanese).

The author makes an observation of scales of young Brook Trout, hatched out in Akeshina Fisheries Institution, Nagano Prefecture; Ôizumi Laboratory, Yamanashi Prefecture; and Yoshino Trout Hatchery, Tôkyô. He describes that the first scale appears in the posterior part of the body. The number of circuli is the largest, followed by the middle part comes the last. He also recognizes the relation between the body and scale lengths, as the body length reaches 1cm. at the stage when the scale in the posterior part of the lateral line appears while for the middle and anterior parts of the same, the appearance of the scale can occur at 2 cm, of the body length. The appearance of the scale is recognizable to stretch faster above than below the lateral line.

KURONUMA, KATSUZO, 1940: Notes on the Form of Eggs in Japanese Rhodeine Fishes of the Genus *Acheilognathus*. Suisan Ken-kyûshi, 35 (9), pp. 234-235. (in Japanese).

The form of eggs in two Japanese rhodeine fishes *Acheilognathus tabira* and *A. cyanostigma* was found to differ in the ratio between diameter and length. The eggs, remaining in the ovipositor, were measured in two females of each species. Comparing these measurement to those given by K. UCHIDA on the Korean species, it was noticed that *A. cyanostigma* of Japan and *A. yamatsutae* of Korea, closely similar externally, have eggs differing in form, the diameter-length ratio is 3.45 in the former and 1.12 in the latter.

MAKINO, SAJIRÔ, 1940: Chromosome Studies on "Funa" and "Kingyo". Zool. Mag., 52(2), pp. 84–85. (in Japanese).

The author studied the chromsomes of many races of gold-fishes. The number is constantly 47 in diploid and 23 in haploid (in first spermatocyte). The shapes of chromosomes are not different in the various races. Furthermore the shapes and number of chromosomes are not distinguishable between those of *Carassius auratus* and gold-fish.

MATSUI, ISAO and YOSHINARI, SABURO, 1940: An Experiment for Fish Group. Suisan Ken-kyûshi, 35 (4), pp. 107–110. (in Japanese).

During the 24th of July, 1939 and the 22nd of August, the authors made some experiments for fish groups composed of gold-fish, eel and "Ayu" (smelt) in the Yoshida Laboratory attached to the Fisheries Institution. The experiments were carried out in the following plans: a). In the case of mixture of carps and crucian carps forming the ratio 1 : 2, the two fish groups separate each other or close together. If the number of two groups is same, they may be separated. b). In the case of gold-fish and carp, the result may be nearly the same to above. c). In the case of carp and eel, the two groups separate in the different layer of water. d). In the case of smelt and eel, the two groups are intermingled. As to the different ages of fish group, the 3rd and 1st year of the carp groups are entirely separate and sometimes intermingled all together.

MATSUI, ISAO, 1940: The Fishes of Lake Suwa and their Food Habits in Summer. Suisan Ken-kyûshi, 35 (5), pp, 19–21. (in Japanese).

The writer investigates the foods of 13 species which are distributed in Lake Suwa. The phytophagus foods are *Diatomacea, Chlorophycea, Oscillatoria* and the zoo-foods are *Crustacea, Mollusca, Insecta, Pisces.*

MATSUI, ISAO, 1940: Food Habits of Fishes of Lake Suwa during the summer season. Suisan Ken-kyûshi, 35 (5), pp. 131–133. (in Japanese).

He examined the stomach contents of 13 species of Lake Suwa fishes collected by T. HOSHINA during 20 days from August 13, 1939. The stomach contents of *Anguilla japonica* are chiefly chironomous larva and pupae together with the larvae of water insects. *Leuciscus hakuensis* appears to be omnivorous while *Parasilurus asotus* is carnivorous, catching large fishes and water insect larvae on the bottom. *Chaenogobius macrognathus* has carnivorous food habits, consisting of fishes and shells, mostly *Semisulcosphira libertina* and *Hypomesus olidus* is chiefly a plankton feeder, catching *Cyclops* and *Bosmina. Cyprinus carpio* and *Carassius auratus* caught the chironomous larva and micro-hytoplankton.

MATSUI, ISAO, 1940: Reaction of Carp to Chemicals. Suisan Ken-kyûshi, 35 (9), pp. 217–224. (in Japanese).

He performed experiments to show the relation between the density of the chemicals; copper sulphate potassium permanganate, Glacial acetic acid and mercurochrome and their toxcity to carp. He indicated the relation between them could be represented by the formula $1/T = KM^P$, but if the concentration of copper sulphate and potassium permanganate is weak, this formula does not hold. The rate of respiration and the concentration of chemicals within the toxic limit, the number may be increased, rising to the maximum and descending to the death. The relation between the fish size and death rate shows sigmoid curve within the toxic range and is a straight line out of the limit. The resistance to chemicals may be weak for the smaller size of fishes. The relation between the temperature and time before death is indicated by $T = 1.478\ D^{1.777}$.

MATSUI, ISAO, 1940: Relation between the Growth and Scale Rings of Carp and Pond Size. Suisan Ken-kyûshi, 35 (11), pp. 300–303. (in Japanese).

He experimented to determine the relation between the growth of carp and the size of pond in artificial small ponds with young carp during August 10, 1938 to January 20, 1939. He has also observed how the scale rings changed in the present experiments.

MATSUI, ISAO, 1940: Number of Eggs in an Ovary of *Plecoglossus altivelis*. Suisan Ken-kyûshi, 35 (12), pp. 330-331. (in Japanese).

The number of eggs produced by *Plecoglossus altivelis* reported by previous observers is not accurate. Shiga Fisheries Experimental Station indicated 3,840-1,400 in a small one and 40,000-68,000 in a large one, while Hiroshima Fisheries Experimental Station counted 6,2000-15,480 in the specimens 9.7cm.-29.7cm. body length. ABE, KEI, showed 40,000-70,000 and KOBAYASHI, HISAO indicated 4-5,000 in fish of less than 35 grm. body weight, ranging from 2-30,000-130,000. The author estimated the egg number in the 60 specimens reared in the Yoshida Laboratory, Fisheries College, during May 10, 1940 to the end of October, by the weight method.

MATSUI ISAO, YOSHINARI SABURÔ, and KAWAMORI MASAO, 1940: Some Reaction of the Carp for Medicines. Suisan Ken-kyûshi, 35 (9), pp. 217-224. (in Japanese).

The authors made the experiments of the chemical reactions for the carps during August of 1939 in the Yoshida Laboratory attached to the Fisheries Institution. They used Copper sulphate, Potassium permanganate, Glacial acetic acid, Merculom in various percentages for the experiments to clear the relation between density of chemical reagents and the mortal temperature.

MATSUI, KIZO, 1940: The Relation between the Embryo of *Aplocheilus latipes* and the water Temperature in the Optimum Temperature Range. Zool. Mag., 52 (10), pp. 380-384. (in Japanese).

The results of his experiments were as follows: The normal development of the embryo of *Aplocheilus latipes* occurs in the water temperature of 17°-31°C. The succession of stage changes is controlled by water temperature.

MATSUI, KIZO, 1940: The Seasonal Changes of Resistance to Higher Temperatures in *Aplocheilus latipes*. Zool. Mag., 52 (10), pp. 380-384. (in Japanese).

He has treated the adults of *Aplocheilus latipes* collected from a suburb of Tôkyô City and fed in the aquarium about a week. The results are as follows; by the sudden treatment of higher temperature, the fishes may die in 16-17°C. while those of September died in 21-22.5°C. The lethal temperature may be 34.5°C. in May and 36.7°C. in September. If we treated the fishes by the gradual increase, the lethal temperature will be higher than when the temperature is changed suddenly.

MIYAZAKI, ICHIRÔ, 1940: Studies on the Japanese Common Goby, *Acanthogobius flavimanus* (T. et SCH.). Bull. Jap. Soc. Scie. Fish., 9 (4), pp. 159-180. (in Japanese).

The author mentions all about Common Goby in this paper. *Acanthogobius flavimanus* (T. et SCH.) is one of the commonest and important gobies which is found very abundantly in the coasts of Japan. It is also very popular for Japanese people as a common game fish as well as a delicious edible fish. But little is as yet known of its life history and no one so far as he is aware, has ever given a scientific description concerning this point. It seems, therefore, worth while to put on record the details of his observation, which were at Kanazawa Laboratory, attached to Tôkyô University at Kanagawa Prefecture from 1938 up to 1940. The present report contains the following section; 1). Distribution, 2). Annual yeild, 3). Habitats, 4). Fishing methods and season, 5). food and feeding habit. 6). spawning season and habit, 7). Secondary sexual characters, 8). Seasonal cycle in the gonad, 9). Number of matured ovarian eggs, 10). Young with reference to those of other gobies, 11). Relation between body-weight and length, 12). Scale, 13). Age, 14). Growth, 15). Maturation; 16). Stock; 17). Sex-proportions, 18). Seasonal change of activity concluded from long-line fishery experiments, and 19). Diseases.

NIWA, HISASHI, 1940: The Oecological Fish Distribution of the main River of Kiso. Zool. Mag., 52 (2), pp. 69-70. (in Japanese).

The author makes observations on the oecological distribution of the fish of the River Kiso from

the lower to the upper. He mentioned peculiar facts in the upper rivers in the middle part of Japan; two species *Oncorhynchus masou* and *Cobitis delicata* are found mixed together. Inconstantable fish for water temperature, *Tribolodon hakuensis* and *Cottus pollux*, *Liobagrus reini*, *Pseudogobio esocinus*, *Gobius similis* are included in this group. *Acanthogobius flavimanus* ascends to the lower stream, *Mugil cephalus* to the middle, while *Lateolabrax japonicus* to the somewhat upper of the middle rivers. Generally, the number of species is smaller in the upper rivers. Then the species gradually increases in number down to the estuary, the species number increases again as the sea fish comes in this region to be found all mixed together. Conclusively, the distribution in the river is mostly controlled by the strong current and lower water temperature.

ODERA, SHUICHI, 1940: Albino of *Pseudorasbora parva*, Bot. & Zool., 8 (12), p. 1937. (in Japanese).

The writer finds an albino of *Pseudorasbora parva*, in a canal of the Fisheries Institution at Hikone, Shiga Prefecture. This specimen is quite white very few black spots scattered on the back.

OKA, TÔHRU, 1940: Striation Pattern of the Epithelium-Cells of Yolk-Sac Membrane and Embryonic Body of *Oryzias latipes*. Cytologia, 10 (4), pp. 524–528.

The author finds out in the summer of 1928, during his study of developing embryos of *Oryzias latipes*, an interesting striation pattern, made of delicate cytoplasmic striations, in the cytosome of large, polygonal eipithelim cells of the yolk-sac membrane. The striation patterns is composed of several sets of paralled striations that are arranged in mosaic to every direction. The peripheral one or the two striations are, however, arranged parallel to the border of cell, while there is no striation that is arranged parallel to the border of nucleus. The first indication of the striations appears in the epithelum-cells of yolk-sac membrane of 13-somite embroyos. At this stage the minute cytoplasmic particles, which were hitherto fore distributed uniformly in the cytosome come to be arranged closely in a line, and then the pieces of striation thus formed become continuous and finally establish the striation pattern. The complete striation pattern is found in the epithelium cells of yolk-sac membrane of the third day embryos.

SATÔ, SHIN-ICHI, 1940: Supplementary Notes on the Fishes from Akkeshi Bay. Jour. Fac. Sci. Hokkaidô Imp. Univ., 7 (3), pp. 99–106.

In this secondary report, he added one freshwater fish *Lampetra japonica* (MARTINS) which was caught at Akkeshi Bay in May of 1938.

YAMAMOTO, TOKI-O, 1940: The Change in Volume of the Fish Egg at Fertilization. Proc. Imp. Acad. Tôkyô, 16, pp. 482–485.

The writer descibes that the cortical alveoli embedded in the cortex of the unfertilized egg of *Aplocheilus latipes* break down on fertilization beginning at the animal pole and ending at the vegetal pole. This is the first visible change of fertilization and the elevation of the chorion comes next. The perivritelline space of the fertilized *Aplocheilus* egg contains a colloidal substance to which the chorion itself is impermeable. It was postulated that this colloidal substance went into solution beween the chorion and the cortex at the time of fertilization and the chorion was elevated by the colloid osmotic pressure. As to the origin of the colloidal substance in the perivitelline space, one possibility is that it may be secreted from the egg-cortex as the cortical alveoli break down. In this connection it is important to know whether or not the volume of the egg proper decreases at the time of fertilization. He said conclusively the egg proper of *Aplocheilus* did shrink after fertilization and consistency of *Aplocheilus* could hardly change the shape by its own weight. It is certain that the size diminution after fertilization is not an illusory phenomenon. Evidently something escapes from the egg concomitant with the breaking down of the cortical alveoli at the time of fertilization. It seems highly probable that the substance in question is a colloid to which the chorion is impermeable, and that elevation of the chorion is due to the colloid osmotic pressure of this substance.

1941

IKEDA, KAHEI, 1941: The Distributions of *Pungitius sinensis* and *Pungitius pungitius* in the Omono River. Zool. Mag., 53 (2), p. 120, (in Japanese).

The author selected 74 stations in the area drained by the Omono River, Niigata Prefecture to collect specimens of the two species. From the result of his observation, the distribution areas of the two species are quite separate and the two species are absolutely not intermingled together, the two different phylogenetical points of the two species are suggested and the author guessed that the *Pung. sinensis* has been land-locked after *Pugn. pungitius* in rather recent times.

INOUYE, KIHEIJI, 1941: Observations on the Winter Band of the Scale in *Cyprinus carpio*. Zool. Mag., 53 (2), pp. 96-97. (in Japanese).

The author has tried to find the relation between the winter band formation and the changes of temperature and food absorption. From the observations of many young hatching during a year, he has found the first formation of scale in the young 20 to 40 days after hatching, and the formation of the winter band seems not related to water temperature and food absorption, It may be rather parallel the development of the gonads in the carp so that the winter band may be an annual zone.

ISHIKAWA, AKIRA and NAKAMURA NAKAROKU, 1941: Life History of *Glossogobius brunneus* (T. et SCH.). Suisan Gakkaihô 8 (1), pp. 1-16. (in Japanese).

The authors studied the breeding habits *Glossogobius brunneus*. The materials were collected from a brackish water fish culture pond, Atsumi Fish Farm Company, Izumimura, Atsumi-gun, Aichi Prefecture. They concluded as follows. The sex difference is exhibited in the configuration of the genital pore and in the second dorsal fin rays of the male longer than those of female. The breeding season is in summer, starting the end of July to the beginning of September. The eggs are adhesive, mostly attached to under surface of substratum. After spawning, the female died from wounds and the male protectd the eggs from their enemies. Egg capsule is convolute in shape, measuring 0.8-0.9 mm. in long axis and 0.35 mm. in short axis. Two inner and outer layers are developed; the outer one fibrous, when the eggs are deposited it makes filaments for attachment while the inner one is strong and when deposited, it makes egg-shell by extruding. Yolk is yellow, intransparent; cytoplasm uniformly distributed, many small oil globules scattered. The newly deposited egg is 3.5 mm. in diameter, covered by an elliptical egg-capsule, with many filaments at the base for attachment to other substratum. After fertilization, the first cleavage begins at 50′, the second at 1°70′, the morula 2°, the embryo formed at 8° and hatches out at 80°. The just hatching out embryo measured 1.04 mm. in body length with melanophores. The embryos measured 1.07 mm. in body length with yolk of 250μ in diameter.

KATAYAMA, MASAO, 1941: Fishes from Maruyama River, Hyôgo Prefecture. (1). Hyôgoken Tyutô Kyoiku Hakubutsugaku Zasshi,* Vol. 7, pp. 368-384, (in Japanese).

The author made a list of fishes found in Maruyama River, Hyôgo Prefecture. It includes 56 species belonging to 25 families and 47 genera. He made a note on the ecological distribution of the fishes. The following species are shown.

1. *Lampetra planeri.*
2. *L. japonica.*
3. *Oncorhynchus keta.*
4. *O. milktschitsch.*
5. *Salvelinus fontinalis.*
6. *Salmo irideus.*
7. *Plecoglossus altivelis.*
8. *Hypomesus olidus.*
9. *Parasilurus asotus.*
10. *Pseudobagrus nudiceps.*
11. *Liobagrus reini.*
12. *Misgurnus anguillicaudatus.*
13. *Cobitis biwae.*
14. *Acheilognathus lanceolata rhombea.*

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* Hoyogo Chutô Kyôiku Hakubutsugaku Zasshi = Magazine of the Natural History of Hyôgo Middle Shool Education, published by the Natural History Society of Hyôgo Prefecture.

15. *A. l. tabira.*
16. *A. l. lanceolata.*
17. *Gnathopogon elongatus elongatus.*
18. *Sarcocheilichthys variegatus.*
19. *Pseudogobio esocinus..*
20. *Hemibarbus longirostris.*
21. *Pungtungia hilgendorfi.*
22. *Pseudorasbora parva.*
23. *Leuciscus hakonensis.*
24. *Phoxinus steindachneri.*
25. *Zacco platypus.*
26. *Z. temmincki.*
27. *Carassius auratus.*
28. *Cyprinus carpio.*
29. *Anguilla japonica.*
30. *Oryzias latipes.*
31. *Gasterosteus aculeatus.*
32. *Hemirhamphus sajori.*
33. *Mugil cephalus.*
34. *Liza haematocheila.*
35. *Lateolabrax japoaicus.*
36. *Coreoperca kawamebari.*
37. *Therapon oxyrhinchus.*
38. *Sparus macrus macrocephalus.*
39. *Cottus pollux.*
40. *C. kazika.*
41. *Paralichthys olivaceus.*
42. *Mogurnda obscura.*
43. *Gobius similis.*
44. *G. giurinus.*
45. *Acanthogobius flavimagnus.*
46. *Tridentiger obscurus obscurus.*
47. *Glossogobius giuris brunneus.*
48. *Leucopsarion petersi.*

KAWABATA, JÛGORÔ, 1941: Fish and Shells of Lake Biwa. KAWABATA JÛGORÔ, Ikôshû Haifukai, pp. 1–198. (in Japanese).

This small book is a posthumous book of Mr. KAWABATA JÛGORÔ who was the head of the Fisheries Research Institution at Shiga-Prefecture. The contents of this book is the Fishes of Lake Biwa, the Transplanting fishes, Propagation, and also important edible shells of Lake Biwa.

The list of fishes of Lake Biwa surveyed by Dr. TANAKA SHIGEO is as follows:

Fam Petromyzonidae:
1. *Lampetra planeri* (BLOCH). "Yatsume"

Bagridae:
2. *Liobagrus reini* HILGENDORF "Akanamazu"
3. *Fluvidraco nudiceps* (SAUVAGE). "Gigi"
4. *Pseudobagrus aurantiacus* (T. et SCH.) Perhaps not existant.

Siluridae:
5. *Parasilurus asotus* (L.) "Namazu"

Cobitidae:
6. *Misgurnus anguillicaudatus* (Cantor). "Dojo"
7. *Cobitis biwae* J. et S. "Shimadojo"
8. *Hymenophysa curta* (T. et SCH.) "Ayu modoki"
9. *Lefua echigonia* J. et R. "Mekura dojo"

Cyprinidae:
10. *Paracheilognathus rhombeum* (T. et SCH.) "Bote"
11. *Acheilognathus lanceolatus* (T. et SCH.) "Bote"
12. *A. longipinne* Regan. "Bote"
13. *A. limbatum* (T. et SCH.). "Bote"
14. *A. cyanostigma* J. et F. "Ichimonjitanago"
15. *A. shimazui* TANAKA. "Aburabote"
16. *Leucogobio jordani* ISHIKAWA. "Yanagi-moroko"
17. *L. biwae* (J. et S.). "Sugomoroko"
18. *L. mayedae* (J. et S.). "Honmoroko".
19. *L. güntheri* ISHIKAWA "Tamoroko"
20. *Zezera hilgendorfi* ISHIKAWA. "Zezera
21. *Sarcocheilichthys variegatus* (T. et S.). "Higai"
22. *Abbottina psegma* J. et F. (may not exist)
23. *Zacco platypus* (T. et SCH.). "Hae"
24. *Z. temmincki* (T. et SCH.). "Mutsu"
25. *Pseudogobio esocinus* (T. et S.). "Kamatsuka"
26. *Otakia rasborina* (T. et S.). "Karasakiugui"
27. *Pseudorasbora parva* (T. et S.). "Ishimoroko"
28. *Ischikauia steenackeri* (SAUVAGE). "Wataka"
29. *Richardsonius hakonensis* (GÜNTHER) "Ugui".
30. *R. jouyi* (JORDAN et SNYDER). "Aburake"
31. *R. caerulescens* (SAUVAGE). (may not exist)
32. *R. japonicus* (SAUVAGE). (do)
33. *Hemitremia steindachneri* (SAUVAGE) "Aburamutsu"
34. *Biwia zezera* (ISHIKAWA). "Zezera"
35. *Hemibarbus barbus* (T. et SCH.). "Nigoi"
36. *Opsariichthys uncirostris* (T. et S.). "Hasu"
37. *Carassius auratus* (L.). "Funa"
38. *Cyprinus carpio* (L.). "Koi"
39. *Tribolodon punctatus* SAUVAGE. "Hoshiugui"
40. *Gnathopogon elongatus elongatus* (T. et SCH.). "Tamoroko"

Anguillidae:
41. *Anguilla japonica* (T. et SCH.). "Unagi"

Salmonidae:
42. *Oncorhynchus masou* (BREVOORT). "Masu"
43. *Salvelinus pluvius* (HILGENDORF). "Iwana"

44. *Plecoglossus altivelis* (T. et SCH.). "Ayu"

Poeciliidae:

45. *Oryzias latipes* (T. et SCH.). "Medaka"
46. *Fundulichthys virescens*(T.et SCH.)."Omedaka"

Cottidae:

47. *Cottus pollux* (GÜNTHER). "Kazika"

Gobiidae:

48. *Rhinogobius similis* GILL. "Ishibushi"
49. *Chloea castanea* (O'SHAUGHNESSY). "Isaza"
50. *Chaenogobius macrognathus* (BLEEKER). "Haze"
51. *Mogurnda obscura* (T. et SCH.). "Donko"
52. *Eleotris oxycephalus* (T. et SCH.). Doman
53. *Acanthogobius flavimanus* (T. et SCH.). "Mahaze" (may not exist)
54. *Chaeturichthys hexanemus* BLEEKER. (do)
55. ? "Gori"

Gasterosteidae:

56. *Gasterosteus cataphractus* (PALLAS). "Hariuwo"

Transplanted Salmonoid fishes in 1909.

1. *Oncorhynchus nerka* (WALBAUM). "Himemasu"
2. *Salmo irideus* Gibb. "Nijimasu"
3. *Salvelinus fontinalis* (MITCH.). "Kawamasu"
4. *Hypomesus olidus* (PALLAS). "Wakasagi"

The author mentioned further biological facts; as spawning and habitats; natural foods; production and fishing amounts, fishing grounds of each species.

KOBAYASI, HISAO, 1941: Additional Notes on the Scales of Japanese Misguillidae. Bot. & Zool., 9 (5), pp. 27–32. (in Japanese).

He has observed the scales of 5 species of Japanese loaches and one species of European loach. From the construction of the scale, he has emphasized that the loaches may be allied to *Phoxinus* of Cyprinidae. He made a key of Misguillidae by the scale characters.

MAKINO, SAJIRÔ, 1941: A Karyological Study of the Gold-fish of Japan. Cytologia, 12 (1), pp. 96–111.

The author carries out the Karyological investigation of the gold-fish varieties. He uses thirteen varieties of the gold-fish to know how the chromosomes are. In the diploid complement (in the spermatogomium) and 47 for the haploid (in the spermatocytes). Morphologically the chromosome complex of the "Funa" and of all the varieties of the gold-fish herein investigated are in complete agreement with one another, both in number and in shape. And thus, there is not the least evidence for the occurrence of the polyploid relationship among the gold-fish varieties.

NAKAMURA, MORIZUMI, 1941: Notes on Three Species of Japanese Bitterlings which spawn in Autumn. Bull. Bio. Geo. Soc. Jap., 11 (11), pp. 97–100. (in Japanese).

The writer studies on the life histories of three Japanese Bitterlings *Acheilognathus rhombea*, *A. longipinnis* and *Pseudoperilampus typus*. They are all spawning from September to November. The eggs of these species are deposited through an tabular ovipositor into the gill chamber of freshwater clams, *Unio douglasiae nippornensis* MARTENS, *Cristaria plicata* LEACH and *Anodonta japonica* CLESSIN.

OSHIMA, MASAMITSU, 1941: Studies on a Rare Salmonoid Fish "Kunimasu" *Oncorhynchus kawamurae* in Lake Tazawa, Akita Prefecture. Nihon Gakujitsu Kyôkai Hôkoku, 16 (2), pp. 254–259. (in Japanese).

The writer studies on *Oncorhynchus kawamurae* in Tasawa Lake and concludes that this species is quite different from "Sakuramasu" by the scale constitution and by the patterns of youngs and also different from the land-locked "Yamame" and *O. masou*. It is also found to be different from *O. rhodurus* "Kunimasu" by the young patterns and the number of anal fin rays and branchial rays. This is quite peculiar a species to Lake Tazawa, and is called *O. kawamurae*.

SEIISHI, REIZÔ, 1941: Life of "Koayu" (a kind of *Plecoglossus altivelis*), Collecting & Breeding,* 3 (3), pp. 64–71. (in Japanese).

* Collecting and Breeding = Monthly Magazine of Collecting and Breeding published by Uchida Rokakuho Co. Ltd. ,Tôkyô.

The author explains the life history of "Koayu" (a kind of *Plecoglossus altivelis*) in Lake Biwa with 16 figures.

SUZUKI, NORIYOSHI, 1941: The Difference of Development of Pearl Organs in *Pseudorasbora parva* (T. et S.) and in *P. pumila* MIYADI.

The author observed the pearl organs of two species *Pseudorasbora parva* and *P. pumila*. In this group (*Pseudorasbora*), the pearl organs appear on the head, fin rays, and scales of trunk. The organs situated on the snout, eye, lower jaw and chin exhibit a regular arrangement. The size of the adult with pearl organs is measured 45.4–64.5 mm. The difference between two species concerning the arrangement of pearl organ is as follows: in *P. parva*, the peculiar, very large pearl organs on the head, while in *P. pumila*, they are nearly of equal size. The pearl organs on the chin is more numerous in *P. pumila*. The arrangement of pearl organs is more regular in *P. parva* than in *P. pumila*.

YABE, HIROSHI, 1941: On the Spawning of *Coilia mystus* (L.), (Engraulidae, Pisces). Bot. & Zool., 9 (7), pp. 21–23. (in Japanese).

The writer investigates the spawning habits of *Coilia mystus* in the lower river of Eizanko, Zenra-Nandô. He also mentions the egg, the development of eggs, hatching out embryo, in comparison with the eggs and youngs of an allied species *Coilia clussumieri*, in the swimming of youngs, the number of depositing eggs, and spawning place and season.

YAMAMOTO, TOKI-O, 1941: The Osmotic Properties of the Egg of Freshwater Fish. *Oryzias latipes*. Jour. Fac. Sci. Imp. Univ. Tôkyô, 5 (3), pp. 461–472.

The writer makes the experiment that the eggs of freshwater fish, *Oryzias latipes*, can develop in redistilled water, fresh water, sea water and in concentrated sea water. Since the chorion of this fish is freely permeable both to water and electrolytes, the protoplasmic surface of the egg appears to be an impermeable membrane. The result of his work is as follows. The osmotic pressure of the egg proper of *Oryzias latipes* was found to be equivalent to 0.134M or M/7.5 NaCl solution. These eggs can develop in distilled water, fresh-water M/2 balanced salt solution, which is equivalent to sea water. The capacity for development in anisotonic media is due to the properties of the surface of the egg proper. The chorion is freely permeable to water and electerolytes and it plays no essential rôle in the maintenance of the osmotic equilibrium of the egg proper. The blastulae of *Oryzias* were allowed to develope in distilled water, M/100, M/2 and 2/3M balanced salt solutions under controlled conditions (Temperature 28°C, p^H 7.3). The time course of the change in size in these anisotomic media was measured for a number of days. It was found that the surface of the egg proper is not an impermeable membrane. Small but definite exosmosis and endosmosis of water occur in hypertonic and hypotonic media respectively. It was proved that the capacity for development in anisotonic media was due to the very slow rate of permeability of water. It is so slow that it does not interfere with normal development in the anisotonic media.

YASUDA, HIDEAKI, 1941: Notes on the Double Rings appearing on the Scales of "Ayu", *Plecoglossus altivelis* T. et SCH. in its First Year. Bull. Jap. Soc. Scie. Fish., 9 (5), pp. 203–207. (in Japanese with English summary).

The author recognizes the double rings on the scales of "Auyu". *Plecoglossus altivelis* T. et SCH. under a year. The inner ring appears in March, when the fish attains 6 cm. in length while the outer ring, in July, when the body length attains from 11 to 15 cm. The appearance of the two kinds of rings can be attibuted to the change in food taken by the fish from animal food to plant food. The outer ring has two strutural types: A-tvpe: detectable by the intersection of pairs of excentrically formed circuli and B-type ; by the narrow width between successive concentric circuli. Either of the two types appears with different relative frequency in the different parts of the fish-body. The said fre-

quency calculated with the scales taken either from every or from a certain definite part of the body shows local difference, namely it has probably a close relation to the forest zones through which the home river flows. A-type as well as the total of A and B types appears frequently in the fish from tropical or subtropical forest region, while B-type has alone the larger frequency with the fish from temperate forest region.

1942

AIKAWA, HIROAKI, 1942: Preliminary Report of the Scale Type of *Oncorhynchus nerka* in Northern Pacific. Suisan Gakkaihô, Vol. 9, pp. 10–15. (in Japanese).

The author distinguished the three types of *Oncorhynchus nerka* found in Northern Pacific from the scale configurations. A type indicating the different arrangements of circuli. The number of circuli somewhat below 10 and B type has 20 or more circuli in number and landrocked while C type has 15 circuli. A dense part of the circuli shows a year ring. This embryo after hatching out, soon descends into sea and grow very rapidly in rate.

AIKAWA, HIROAKI, 1942: Calculation of Fishing and Natural Mortality Rates, and their Bearings on the Stock Exploitation. Suisan Gakkaihô, Vol. 9, pp. 16–22. (in Japanese).

The author carried out the marking experiments of *Seriola quinqueradiata* and *Gadus macrocephalus* to clear the rate of natural mortality and fishing calculation. Judging from these rates with growth rate, the optimum yield can be attained by the present fishing rate, 22% from *Seriola* stock, while *Gadus* stock can be fished, without being injured, more intensely than by the present rate 11.6%. On the contrary, the present rate, 32.3% is better to be lowered a little for the spring herring stock of Hokkaidô.

MATSUI, YOSHIICHI, 1942: Sex of Freshwater Fishes. Dobutsu Bungaku,* 9 (6), pp. 40–44. (in Japanese).

The author made general descriptions of the sexes of freshwater fishes. The sexual difference of outer features of both sexes, the pearl organs, nuptial colour, sex ratio, the genetics of sex and hermaphroditism of the freshwater fishes.

1943

HOKKAIDÔ, HATCHERY, 1943: Notes on the Habits and the Artificial Hatching of "Kawayatsume." Nôrinjihô,** 3 (15), pp. 18–21. Figs. 1–3, August 1, 1943. (in Japanese).

The authorities of Hokkaidô hatchery made the observations of the ecology and the spawning habits of "*Kawayatsume*" in the Ishikari River, Hokkaidô. Two groups of "*Kawayatsume*" ascend the Ishikari River, one is the spring migrant and the other is the autumn migrant. By feeding in a pond the autumn migrant may mature in the next spring and deposit the eggs. The spring migrant usually ascends to the upper river and spawns under the pebble bottom. At the female makes a shallow hole, 40 cm. in diameter and 15–20 cm. in depth with the help of the male. The female attaches herself by suction on a stone in the hold and streches out her body in the rest. The male attaches himself by suction on the head and the lateral side of the ventral of the female's body. The male curves his tail at right angles to their parallel position and coils round the upper part of the female, and presses tightly. The male tatches the ejaculatory spine to the female genital pore and ejaculates the sperms to the eggs. At one motion, the female deposits about 100 eggs. These depositions may be continued for several days until all the eggs are deposited. The male and female may die within a few days

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* Dôbutsu Bungaku = Magazine of Animals concerned with Literature. Tôkyô.

** Nôrinjihô = Bulletin of Agriculture and Forestry published by the Bureau of Agriculture and Forestry attached to the Ministry of Agriculture and Forestry, Tôkyô.

after spwning. The eggs are slightly adhesive and deposited at the bottom. The hatching larva is very slender measuring 5–7 cm. in length, resting in the water for two days, and then buries itself in the muddy or sandy bottom. Ammocete stage is spent in the sand and when it reaches 17–23 cm. body length, it descends into the sea. It is not certain when this young may ascend in autumn, after spending a half year in the sea. The number of eggs contained in a female is 72, 945 as an average. The relation between the number of eggs and the female body length is given as follows:

Body length.	Number of eggs.
41cm.	58,500–78,000
39cm.	52,000–78,000
38cm.	67,600–92,300
35cm.	67,600
Average ···	72,945

HUBBS, C. L, and KURONUMA, KATSUZÔ, 1943: Egg and Ovipositor Characters in two *Acheilognathisse* Fishes from Japan. Copeia, No. 3, pp. 183–186.

These authors observed the eggs in ovipositors of two Japanese bitterlings, *Acheilognathus tabira* JORDAN et THOMPSON (on June 21, 1929, in Tone River Chiba Prefecture) and *Acheilognathus cyanostigma* (July 4, 1929, Southern Basin of Lake, Biwa Shiga Prefecture). They made the conclusions as follows; Some difference between individuals may be observed in the size of the eggs. The individual and specific differences also appeared in the length of the fully extended ovipositor of the two species. The differences between the two species are of particular interest, since the species are regarded as very closely related.

INUKAI, TESUO and SATÔ, NOBUICHI, 1943: Breeding Habits of *Salvelinus miyabei* OSHIMA in Hikaribetsu of Hokkaidô. Zool. Mag., 55 (2), pp. 78–79. (in Japanese).

The land-locked trout *Salvelinus miyabei* usually found in Lake Hikaribetsu, ascend into three rivers from the beginning of September to the end of November when the breeding season starts. The sex ratio is 1 : 1 at that time and the male is larger than the female. The average number of eggs in the total of 33 females measuring 210–240 mm. in length was 326.9. The diameter of the eggs was 4.5–5.8 mm. It takes about one month to spawn after ascending the rivers to the spawning areas where an elliptical shaped nest 20 to 35 cm. long is made of sand and pebbles and in which eggs are buried under 5 or 6 cm. of sand.

ISHIDA, JURÔ, 1943: Notes on the hatching Enzyme of the Egg of *Aplocheilus latipes*. Zool. Mag., 55 (2). p. 55. (in Japanese).

The author discovered on enzyme on the hatching embryos. During the observation of the eggs of *Aplocheilus latipes*, he has found the piercing and dissolving phenomena on the egg membrane is due to the function of a ferment. A milky mass of granules on the opercle of an embryo disappears just before hatching. We could get the granules separately and gather them with a slender glass capillary. The granules are soluble in distilled water. They are effective in piercing the egg membrane, when the embryo is hatching out.

ISHIDA, JURÔ, 1943: Notes on the Development and Histology of the Hatching Ferment Gland of *Aplocheilus latipes*. Zool. Mag., 55 (4), p. 172. (in Japanese).

The author has studied the development of the ferment gland which appears on the place of future opercle formation of the embryo. This gland has a endodermal origin and increases the size with the developmental stages of the embryo. At the beginning of the movement of the opercle, the gland may be broken by the water pressure and secrests the ferments which serve the function of dissolving

and piercing the egg membrane.

KAMOHARA, NENJI, 1943: Notes on Fishes from Tosa. Tosano Hakubutsu,* p. 8. (in Japanese).

The author mentioned 25 species of freshwater fishes from the rivers of Tosa. *Acheilognathus moriokae* was listed in his report but its existance in that river is quite doubtful.

KATAYAMA, MASAO, and NAKAJIMA NORIMASA, 1943: Figures of Freshwater Fishes of Hyôgo Prefecture. Hyôgoken Tyutôkyoiku Hakubutsugaku Zasshi, No. 8–9, pp. 136–139. (in Japanese).

The author made the figures and brief descriptions of the freshwater fishes found in Hyôgo Prefecture. This paper contains the descriptions and figures of nine species belonging to the families Siluridae, Bagridae, Cyprinidae, Serranidae and Gobiidae.

MATSUI, KIZÔ, 1943: Constant Temperature and Time Factor of Heart beating of *Aplocheilus latipes*. Zool. Mag., 55 (2), pp. 54–55. (in Japanese).

When we increase the temperature 1°C. during every 2 minutes, the heart beating rate quite fits the ARRHENIUS formula and the critical point may be 27–28°C. In this case, the constant temperature number is 17700–14400 and 15900 as average. But when we increase the temperature 1°C. in every minute, the critical point may be 26–23°C. In this case, the constant temperature number μ is 19300–14500 and 16700 in average. After we increase the temperature 1°C. in 10 mintues and we keep the temperature constant the critical point follows: ARRHENIUS formula in every case. The value of at highest temperature is 10200 and at lowest temperature is 15300.

MATSUI, YOSHIICHI, 1943: Introduction of Gold-fish and Historical Sketch of Breeding. Rekishi Nihon,** 2 (7), pp. 1–8. (in Japanese).

The author considered the history of the introduction and breeding of the gold-fish. The original places may be Sekko and Kosei of China. The oldest record in Japan, was made by HAYASHI MICHIHARA in "Tashikihen", published in the 12th year of Keichô (1607). The gransmmission from China to Japan is add to have occurred in 1502 (Bunki 2nd year) and the place is considered to be Sakainotsu, Sensyû (at present Sakai City, Osaka). The species was "Wakin" and introduced by the Ming people of China.

MATSUI, YOSHIICHI, 1943: Notes on Eel Culture. Nihongakujitsu Kyokai Hôkoku, 17 (2), pp. 111–115. (in Japanese).

The author has sketched the history of eel culture and given an introduction to the general aspects of eel culture.

MATSUI, YOSHIICHI, 1934: Notes on the Digestive Organs of the Hybrids among Carp, *Carassius* and Gold-fish. Zool. Mag., 55 (2), pp. 88–89. (in Japanese).

From the macroscopical and microscopical constructions, the hepatopancreas of carp, Carassius and gold-fish are different. He experimented by interbreeding carp and *Carassius* (two years) and carp and gold-fish (4 years) and made clear the following facts. The hybrid indicated the same turning of the intestine as that of the carp and the situation of hepatopancreas into the liver and spleen as that of the carp.

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* Tosano Hakubutsu = Natural History Magazine of Tosa Province, Kôchi Prefecture published by the Natural History Society of Tosa, Kôchi.

** Rekishi Nihon = Magazine of History of Japan.

MATSUI, YOSHIICHI and MAKINO, SAJIRÔ, 1943: Notes on the Intersex of the Hydrid between Crucian Carp and Carp. Zool. Mag., 47 (562, 563), pp. 545–551, pl. 1. (in Japanese).

The authors found 28 examples of hermaphroditism in the hybrids between *Carassius* and carp. They found ovo-testis in a degenerated testis with very few ovum in the testis. The tissues of ovum and testis are quite separated in ovo-testis.

MATSUI, YOSHIICHI, 1943: Catalogue of Literature on Gold-fish, first part, complement. Cyosô Bunko, pp. 1–6. (in Japanese).

He made a complemental catalogue of gold-fish literature and wood cut prints issued from 1612 (Keichô 17) to 1934 (Showa 18).

MATSUI, YOSHIICHI, 1943: List of Literatures about Gold-fish. Rekishi Nihon, 2 (7), pp. 1–34. (in Japanese).

The writer makes a list of literatures about gold-fish in 1629–1940. It includes a coloured picture, paper and all other kinds of publications concerned with gold-fish.

OKADA, YÔ, KANAME, 1943: Regeneration of the Tail in Fish. Ann. Zool. Jap., 22 (2), pp. 59–67.

The investigations of the regeneration of the tail in fish having yet reached no satisfactory conclusion, the author used the "Medaka" (*Aplocheilus latipes*) for this experiments. In this fish, the regeneration of the caudal fin not only took place readily, but also did not require the presence of the stumps of the raylets or of any part of the basal plate for the realization. Even when the amputated portion of the tail included several vertebrae, the caudal fin was still able to develop at the site of the cut. In such cases the posterior side of the cut vertebra grew out into a semicircular disc, which constituted the compensatory basal plate to support the new raylets. The capacity to regenerate the caudal fin decreased rapidly as the level of amputation was moved anteriorly and disappeared entirely when the latter approached the posterior limit of the anal fin. With respect to the regeneration of the tail the larval fish did not necessarily surpass the adult, for even in newly hatched larva the regeneration was limited to the formation of the fin immediately at the site of amputation. The notochordal protuberance from the wounded surface in the larva seems to have obstructed rather than promoted the regenerative process. Within the scope of present knowledge the regeneration of tail in both the larval and adult forms of *Aplocheilus latipes* is comparable only to that in the pipe fish (*Syngnathus acus*), as described by DUNCKER.

1944

ISHIDA, JURÔ, 1944: Hatching Enzyme in the Freshwater Fish, *Oryzias latipes*. Ann. Zool. Jap., 22 (3), pp. 173–154.

The author finds out that the gland cells for hatching out occur for the first time at the stage of melanin formation on the eye (3 or 4 day embryo at 25°C) and occurs in the region where gills develop at a later stage. These gland cells or giant cells (ca. 18μ in diameter *in vivo*) disappear completely after the hatching and the embryonic body becomes quite transparent. Each of them is provided with a nucleus and many eosinophilic granules, which have a small amount of haematoxylin-stainable substance. Glandular hatching cells are derived from endodermal cells and differentiate at an early embryonic stage when melanin appears on the eye. These cells migrate forward and form the epithelium of the foregut. The secretion or disintegration of the glandular contents induced by the beginning of opercular movement. M/4 KCL inhibits hatching and M/8 KCL accelerates it, when embryos shortly before the hatching are immersed in them. Hatching occurs in a solution of 0.1 or 0.2 percent "Ueronal Natrium", which suppresses the body biginning of opercular movement of the embryo, but not the opercular movement. It is the granules in the hatching glands that perforate the chorion, dissolving them ultimately at the hatching. The dissolving activity of the secretion of hatching glands has an optimal temperature (30–40°C) and an optimal pH (8.0–9.0), and is thermolabile. The agent is adsorbed by Kaolin, is not dialyzed through a celloidin membrane, and is inac-

tivated by cuprous sulphate. From these results he concludes that the dissolving power is due to an enzymatic activity.

ISHIDA, JURÔ, 1944: Further Studies on the Hatching Enzyme of the Freshwater Fish, *Oryzias latipes*. Ann. Zool. Jap., 22 (3), pp. 155–164.

The author describes the further studies on the enzyme and the chorion of *Oryzias latipes*. The enzyme begins its activity in the 5 day embryo and becomes most active at the hatching. Opercular movement and hatching are inhibited by 0.03% chloretone and accelerated by M/4 NaCl. M/3 NaCl shows no effects at all. M/8–M/3 $CaCl_2$ inhibits opercular movement and hatching. The hatching enzyme digests gelatin. It was detected by GATE's method and GRASSMANN-HEIDE's micro-alcohol titration method. The range of pH-activity is between 7.0–9.0. The liquefaction of gelatin by the hatching enzyme (GATE's method) was inhibited with 0.02 NKCN and 0.04 NH_2S. Th eproteinase in the hatching enzyme may be a tryptase. The chorion is attached by trypsin, pancreas extract, and the same extract is activated with KCN.

YAMAMOTO, TOKI-O, 1944: Physiological Studies on Fertilization and Activation of Fish Eggs. I. Response of the Cortical Layer of the Egg of *Oryzas latipes* Ann. Zool. Jap., 22 (3), pp.109–125.

The author studies on the fertilization and activation of freshwater fish, *Aplocheilus latipes* from physiological view point. This first report treats chiefly the response of the cortical layer of the egg. He concludes as following. In unfertilized eggs of the fish, the cortical alveoli are evenly embedded in the cortical protoplasm. The first visible change at fertilization is the breakdown of the cortical alveoli. They break down in a wave-like fashion beginning at the animal pole and ending at the vegetal pole. The change is subsequently followed by the elevation of the chorion which begins at the animal pole and the fusion and migration of oil droplets towards the vegetal pole. The presence of *Ca* ions is a *sine quanon* condition in the normal fertilization and *Ca* ions can be replaced by *Mg* ions. The former is more effective than the latter. The breakdown of the cortical alveoli and the subsequent elevation of the chorion can be induced by the agents of artificial parthenogenesis. Surface active substances such as sodium taurocholate, sodium, glycocholate, sodium oleate, saponin, and digitalin bring about the breakdown of the cortical alveoli beginning at the animal pole and ending at the vegetal pole. Ripe eggs are also activated by thermal treatment and pricking with a fine glass needle and electric stimulation. Pricking and electric stimulation indicate that the response is provoked at any point of the cortical layer and that the sensitivity is the highest at the animal pole and the lowest at the vegetal pole. These experiments also indicate that the change underlying the breakdown of the cortical alveoli can potentially propagate in all the directions, which spreads more rapidly near the animal pole than near the vegetal pole. The breakdown of the cortical alveoli is not only the first visible change in the fertilization and parthenogenetic activation of fish eggs but that the formation of the perivitelline space and other changes are the consequence of the breakdown of the cortical alveoli. He has suggested that some sort of invisible change or "impulse" was provoked at the cortical layer by the sperm or activating agents and it propagated in wave-like fashion as the cause of the breakdown of the cortical alveoli. Thus the visible wave-like breakdown of the cortical alveoli ensues.

YAMAMOTO, TOKI-O, 1944: Physiological Studies on Fertilization and Activation of Fish Eggs. II. The Conduction of the "Fertilization-Wave" in the Eggs of *Oryzias latiqes*. Ann. Zool. Jap., 22 (3), pp. 126–136.

In this paper, he deals with some experiments on the regional difference in irritability of the cortex and on the nature of conduction of the "Fertilization-wave". He concludes that the ripe unfertilized eggs of the fish, *Aplocheilus latipes*, and the cortical alveoli are embedded in the cortical protoplasm. The first visible change at the fertilization is the wave-like breakdown of the cortical alveoli which begins at the animal pole and ends at the vegetal pole. Parthenogenetic agents also bring about the breakdown of the cortical alveoli. It was postulated that a reaction of some kind or an "impulse"

might be provoked by the sperm or activating agents. This impulse which causes the alveolar breakdown is conducted in wave-like fashion. The invisible wave may be termed the "fertilization wave". The breakdown of the cortical alveoli is the sign and consequence of this wave. The intensity of the "impulse" provoked by the sperm or activating agents is dependent on the strength of "stimulation" so that the all or none principle can not be applied. The intensity of the "fertilization-wave" propagates with decrement.

1945

TAKEDA, RYOITSU, 1945: The Distribution of the Different Types of *Cobitis biwae* with Different Patterns on the Body. (in Japanese, own publishing).

The writer divides *Cobitis* into A-D types by the different patterns on the body. From these specimens, A type is most aboundant occupying about 57.6% and it may be a typical form.

1946

EGUCHI, HIROSHI, 1946; Some Experiment of the Current Water Feeding of Carp in Hokkaidô. Rep. Hokkaidô Fish. Hatch*, 1(1), pp. 35-38. (in Japanese).

Since the Gumma, Nagano and Gifu Prefectures carrying out a feeding of carp by current water, the Hokkaidô Fisheries hatcheries tried to make some experiment on the current water carp feeding during July 9th and October 27th of 1943 and gained some results.

FUJITA, TADASHI, 1946; Increasing of Carp in Yamaguchi Prefecture. Special Number of Fisheries Leading Institute of Yamaguchi Prefecture. No. 8, pp. 1-11. (in Japanese).

The author demonstrated the present status of *Inada carp* feeding carried in the Yamaguchi Prefecture and made a consideration of the experiments to be made in future.

FUJITA, TADASHI, and OBAYASHI, MASAMI, 1946; Notes on the Artificial Feeding Scheme of Loach, *Misgurnus anguillicaudatus*. Report of Fisheries Leading Institute of Yamaguchi Prefecture. No. 8. pp. 1-2. (in Japanese).

They have tried some experiment on the seedlings of loaches by the injecting hormone contained in the anterior lobe of hypophysis of frog. From this result, they would announce some good idea to propagate loaches in a pond artificially.

KANO, YASUHIKO, 1946: Ecological and Morphological Studies of *Tribolodon hakuensis hakuensis* (G.). Hokkaidô Teikoku Daigaku Rigakubu Dôbutsugaku Kyôshitsu Daiichi Kôza Kenkyû Gyosei Shoho, 1(2), pp. 20-23. (in Japanese).

The author studied the present species found in Utomite Swamp, Yuhutsu-gun, Iburi, Hokkaidô. On the ecological studies, he has discussed mostly the migration, spawing habits and the nuptial colours. On the morphological studies, he computed the ratios of the various parts of fish body; the variations of head length and eye diameter, and the relative growth of the body. He has identified two forms in the vicinity of Utomite swamp, one is *Tribolodon taczanowskii* (S.) and the other is *T. hakuensis phalacrocorax*.

KANO, YASUHIKO, 1946: The early Development of *T. hakuensis* (G.) of Hokkaidô. Hokkaidô Teikoku Daigaku Rigakubu Dôbutsugaku Kyôshitsu Daiichi Köza Kenkyûgyôseki Shôhô, I (2), pp. 23-25. (in Japanese).

The author observed 25 stages in the development of *T. hakuensis hakuensis*, from the fertilization of the egg to hatching of the larva.

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* Rep. Hokkaidô Fish. Hatch = Report of Hokkaidô Fisheries Hatcheries, published by the Hokkaidô Hatcheries, attached to the Fisheries Experiment Station, Hokkaidô. Yoichi, Hokkaidô.

KUBO, IZUO, 1946: On the Stock of *Hypomesus olidus* (BREVOORT) in Lake Kitaura. Seibutsu*, 1 (4), pp. 227-229. (in Japanese).

The material on which the present article is based was taken on 15 th November, 1944 by a kind of fixed net, from 8 localities, standing near the shore of Lake Kitaura which is an elongated lake (ca. 26 KM. long, 14 KM. wide). *Hypomesus olidus* is found with many trematodecysts on the integument. So far as my investigation goes, the stock of the fish may be split into 3 -- the 1st lives in the northern part of the lake, the 2nd in the middle part and the 3rd in the southern part, based on the rate of the parasite cysts.

MATSUSHITA, NORITA, 1946: Notes on Some Experiment on the Taste of *Phoxinus percnurus sachalinensis*. Hokkaidô Teikoku Daigaku Rigakubu Dôbutsugaku Kyoshitsu Daiichikôza Kenkyû Gyôseki Shôhô**, 1 (2), p. 13. (in Japanese).

The author made an expreiment of salt taste for *Phoxinus percnurus* which is aboundant in the vicinity of Sapporo, Hokkaidô. He used a blind fish for this experiment and recognized the reaction to salt at 1/320 mole in fish while the reaction to salt is 1/40 mole in human body. The other inorganic salts KCL, $MgCl_2$, $CaCl_2$, $MgSO_4$, anb $NaSO_4$ may be reacted as ordinary salts, tasted for the fish. The synthetic organic compounds called "Azinomoto" included Gurtamin Natrium may be reacted as former salts. But hydrochloric acid and hydrochloric Kinin may not reacted for fish. From these experiments, the author concluded that this fish may be reacted by special reagents.

MATSUSHITA, NORITA, 1946: Some Experiment on the Taste of *Phoxinus percnurus sachalinensis*. Hokkaidô Teikoku Daigaku Rigakubu Dôbutsugaku Kyoshitsu Daiichikoza Kenkyû Gyoseki Shôhô, 1 (2), p. 13. (in Japanese).

He has made and experiment to determine the sensitivity to salt of *Phoxinus percnurus sachalinensis* which is found aboundant in the vicinity of Sapporo. He used a blind material and found a reaction to salt at 1/321 mole while man has a reaction at 1/40 mole. The other materials, including an organic salt, KCL, $CaCl_2$, $KgCl_2$, $MaSO_4$, $NaSO_4$, may be given the same taste reaction as salt for a fish. The organic compound "Azinomoto" that is Gurtamin Natrium, may produce the same sensation. But this fish does not react at all to hydrochloric acid and hydrochloric kinin. From this fact this fish may be peculiar in its reaction to these reagents.

OKADA, YAICHIRO; NAKAMURA, MORIZUMI, 1946: The Freshwater Fishes of Shikoku and Awaji Island. Shigen Kagaku Kenkyûsho Daini Kenkyûbu Gyôseki***, No. 78, pp. 1-11. (in Japanese).

The authors report 42 species, 3 subspecies of 14 families and 36 genera by their collections which were made during 1945. The species and localities are as follows.

1. *Lampetra planeri*. Shikoku; Yoshino River
2. *Oncorhynchus rhodurus*; Many rivers in Shikoku
3. *Plecoglossus altivelis*. Shikoku; Awaji Island
4. *Aplocheilus latipes*. Shikoku; Takamatsu, Awaji Island
5. *Parasilurus asotus*. Shikoku; Awaji Island
6. *Pelteobagrus nudiceps*. Shikoku; Yoshino River.

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* Seibutsu = "Biology": published by Hokusuisha Co. Ltd., Sapporo, Hokkaidô.

** Hokkaidô Teikoku Daigaku Rigakubu Dôbutsugaku Kyoshitsu Daiichikôza Kenkyû Shôhô = Miscellaneous Report of the Zoological Institute of Faculty of Science, Hokkaidô Imperial University, Sapporo, Hokkaidô.

*** Shigen Kagaku Kenkyûsho Daini Kenkyûbu Gyoseki = Report of the second Research Section ot the Research Institute for Natural Resources published by the Research Institute for Natural Resources, Tôkyô.

7. *Liobagrus reini*. Shikoku; Tokushima Pref., Kôchi Pref., Awaji Island.
8. *Acheilognathus lanceolata*. Shikoku; Tokushima Pref., Kôchi Pref., Ehime Pref., Kagawa Pref.
9. *Acheilognathus limbata*; Shikoku; Takamatsu; Awaji Island.
10. *Hemibarbus barbus*; Shikoku; Tokushima Pref., Kôchi Pref.,
11. *Gnathopogon elongatus elongatus*. Shikoku; Kôchi Pref., Ehime Pref., Kagawa Pref., Awaji Island.
12. *Gnathopogon gracilis*. Shikoku; Tokushima Pref., Kagawa Pref.
13. *Pseudogobio esocinus*. Shikoku, Kôchi Pref.
14. *Pungtungia herzi*. Shikoku, Kagawa Pref.
15. *Pseudorasbora parva*. Shikoku, Tokushima Pref., Ehime Pref., Awaji Island.
16. *Tribolodon hakuensis*. Shikoku, Tokushima Pref., Kôchi Pref.
17. *Moroco steindachneri*. Shikoku; Kagawa Pref., Kôchi Pref.
18. *Zacco platypus*. Shikoku; Tokushima Pref., Kôchi Pref., Ehime Pref., Kagawa Pref., Awaji Island.
19. *Zacco temmincki*. Shikoku; Tokushima Pref., Kôchi Pref., Ehime Pref., Kagawa., Awaji Island.
20. *Hemigrammocypris rasborella*. Shikoku; Tokushima Pref., Kagawa Pref.
21. *Carassius carassius*. Shikoku; Awaji Island.
22. *Cyprinus carpio*. Shikoku; Awaji Island
23. *Misgurnus anguillicaudatus*. Shikoku; Kôchi Pref., Kagawa Pref.
24. *Iefu echigonia*. Shikoku; Kagawa Pref.
25. *Cobitis biwae*. Shikoku; Tokushima Pref.
26. *Cobitis taenia striata*. Shikoku; Kagawa Pref.
27. *Anguilla japonica*. Shikoku; Kôchi Pref.
28. *Anguilla mauritiana*. Shikoku; Kôchi Pref. Ehime Pref.
29. *Gasterosteus aculeatus aculeatus*. Shikoku; Ehime Pref.
30. *Coreoperca kawamebari*, Shikoku; Kagawa Pref.
31. *Therapon oxyrhynchus*, Shikoku; Kôchi Pref.
32. *Therapon jarbua*, Awaji Island.
33. *Cottus kazika*, Shikoku; Kôchi Pref.
34. *Cottus pollux*, Shikoku; Kagawa Pref.
35. *Eleotris oxycephala*, Shikoku; Ehime Pref., Awaji Island.
36. *Mogurnda obscura*, Shikoku; Tokushima Pref., Kôchi Pref., Ehime Pref., Kagawa Pref., Awaji Island.
37. *Luciogobius guttatus*, Shikoku; Kôchi Pref.
38. *Leucopsarion petersi*, Shikoku; Ehime Pref.
39. *Acanthogobius flavimanus*, Shikoku; Ehime Pref.
40. *Gobius similis*, Shikoku; Tokushima Pref., Kôchi Pref., Kagawa Pref., Awaji Island.
41. *Gobius gymmachen*, Shikoku; Ehime Pref.
42. *Chaenogobius urotaenia*, Shikoku; Ehime Pref.
43. *Chaenogobius annularis*, Shikoku; Ehime Pref.
44. *Glossogbius brunneus*, Shikoku; Ehime Pref.
45. *Tridentiger obscurus*, Awaji Island.

WATANABE, MASAO, 1946: The Life History of *Macropodus chinensis* (BLOCH), I., Bot. & Zool., 8 (8, 9), pp. 186–189. (in Japanese).

The writer observes the life cycle of this fish in nature and in laboratory, He collected the specimens from Yotsugi, Katsushika-gun, Tôkyô and fed in a small aquarium to observe the life cycle. He also observed the distribution of food, fighting habits and spawning habits.

WATANABE, MASAO, 1946: The Life History of *Macropodes chinensis* (BLOCH) II, Bot., & Zool., 8 (12), pp. 225–229. (in Japanese).

In the second report, the writer mentions the development of egg with many pictures from the lst segmentation of eggs to the youngs measured 25.5 mm. in body length.

1947

NAKAMURA, NAKAROKU, 1947: Food-Habits of Young Carp. Bull. Jap. Soc. Scie. Fish., 13 (3), pp. 111-112. (in Japanese).

Most of the youngs take a small crustacea, rotifer in natural. The author made an observation on the food of the young at the end of March and understood that the youngs would take Protozoa, unicellular Algae, Rotifer and *Moina macrocopa* STRAU. He also acknowledge that the youngs 2 or 3 days after the hatching out would take the food of micro-organisms and 5 days after they would take a larger food of *Alonaor* or *Moina*.

YAMAMOTO, GOTARÔ and NISHIOKA, CHUZÔ, 1947: On the Rearing of the Larvae of Japanese Halfbeak, *Hyporamphus sajori* (T. et Sch.). Seibutsu, 2 (5), pp. 136-140. (in Japanese with English summary).

They study the life cycle and rearing of *Hyporamphus sajori* which is caught around Aomori Bay, Aomori Prefecture, The eggs have the well-developed adhesive filaments on the surface. Hatching larvae were measured 6.2-6.7 mm in total body length. In 10 days after hatching out they attain 12 mm long, The post-larva of 22-28 mm in body length shows the adult form. It takes small crustaceans, especially copepodite naupleus and molluscan larvae for food.

1948

FUJITA, TADASHI and UNO, K, 1948: On Artificial Taking-Eggs of Loach by Injection of Pituitary Hormone. Bull. Jap. Soc. Scie. Fish., 13 (6), pp. 254-258. (in Japanese).

The writers make some experiments of the pituitary hormone of frog to discharge the eggs in the ovary of loach. Their method is as follows. At 24°C of water temperature, about 17 hours after the injection of pituitary hormone of frog, unripe eggs in the ovary of loach came to be ripened and discharged; they are sure to make the all loaches (body weight 8-40 gm) discharge the eggs by the injection of 2 pieces of pituitary hormone of *Rana nigromaculata*, but in case of the larger bodies, it may be necessary to use more volume of the hormone. In their experiments, they obtained the result of 79.6% in the average hatching rate by the artificial fertilization of the eggs which were resulted by the injection of the hormone.

HERVEY, G. F. and HEMS, J., 1948: The Gold-fish. London the BATCHWORTH Press. pp. 1-232.

Two authors mentioned all about gold-fish on the Anatomy, Fancy Gold-fish, History, Environment, Electing and Transporting, Foods and Feeding, Disease, Parasites and Enemies, Breeding, Showing, the gold-fish and all the Arts, other Fishes for aquarium and Pond, in many Languages; Bibliography and Index.

ICHIKAWA, MAMORU and KAWAKAMI, IZUMI, 1948: Spawning induced in the Carp with the Injection of the Pituitary Hormone. II. Effects on the Mature Females which are unable to spawn, as well as Premature Ones. Seibutu, 3 (2), pp. 53-57. (in Japanese with English resume).

This is the second paper concerned with this topic. Of the carp there are some which are, though mature, unable to lay eggs in the breeding season. When they receive, daily or every other day, the injection of gonadotropin, prepared from the pregnant women's urine, with or without the saline suspensions of the pituitary bodies from the dog-fish, they are induced to spawn after several treatments. A similar experiment was performed on the premature females with the same result of natural spawning: In the third experiment, gonadotropin and pituitary suspensions were separately injected into the premature females and the former seemed to be less eff8tive than the latter. Never-

theless, the mammalian pituitary hormone was thus demonstrated to be effective to the development and expulsion of eggs of the carp.

IMAI, SADAHIKO, 1948: On *Aphyocyris chinensis* GÜNTHER collected in the Vicinity of Fukuoka. Seibutsu, 3 (3-4), pp. 121-123. (in Japanese).

This is the first record of *Aphyocypris chinensis* in Japan. The writer collected it together with *Hemigramocypris rasborella* FOWLFR in the rivers and streams around Fukuoka City, Fukuoka Prefecture. This species is widely distributed in China, Manchuria and Korea. From the geographical distribution of the present species, there seems to be recognized some correlation between the northern part of Kyûshû and Manchuria.

NAKAMURA, KAZUO, 1948: On Artificial Breeding of "Kyuri-uwo", (*Osmerus dentex* STEINDACHNER). Bull. Jap. Soc. Scie. Fish., 13 (6), pp. 259-262. (in Japanese).

The author makes an experiment in formalin and sea-water disinfection methods on the growing eggs of *Osmerus dentex* STEINDCAHNER which are obtained at the Kuninui River around Hakodate, Hokkaidô during the end of April and the beginning of May. He used 5% formalin for half an hour, best hatching rate was obtained. But its application should be avoided for hatching eggs; it showed no effect on the water-mold which had already grown, as the dead water-mold body covered the eggs to die. Sea-water had the same disinfecting power as formalin, showing no bad influence on eggs even in the case of 4 hours-immersing.

OKADA, YAICHIRÔ and NAKAMURA, MORIZUMI, 1948: Studies on the Races of *Carassius carassius* (L.) in Japan. 1. *Carassius carassius carassius* (L.) in Jô-numa, a small lake in Gumma Prefecture. Bull. Jap. Soc. Scie. Fish., 13 (6), pp. 279-284. (in Japanese).

The authors consider three races of *Carassius carassius* in Japan to investigate them in natural. They observe the three populations in Jô-numa, one of the small lakes of Gumma Prefecture. The first one, "Kin" or gold "Funa"; the second one "Gin" or silver "Funa" and the third one, "Gengorô Funa" introduced from Lake Biwa.

OKADA, YAICHIRÔ and NAKAMURA, MORIZUMI, 1948: Nihon no Tansui-Gyorui. Nihonshuppansha, Ôsaka. (in Japanese).

This is a book to show a general idea of Freshwater Fishes of Japan. In the general part, Morphology including external feature and internal feature and in the second part, Classification, Evolution, Distribution, Reproduction, Food Habits, Fishing and Fishing apparatus, Propagation, Collection and Breeding. In the second part, the Morphology and Ecology of every species.

TSUKAHARA, HIROSHI, 1948: The Relation between the Secondary Sex-Characters and the Spawning Habits in the Loach, *Misgurnus anguillicaudatus* CANTOR. Seibutsu, 3 (2), pp. 64-69. (in Japanese).

The writer finds out new secondary characters of *Misgurnus anguillicaudatus* which may be related to the breeding action.

WATANABE, MASAO, KOBORI, NOBEJI and MATSUKI, AKIRA, 1948; Development of *Misgurnus anguillicaudatus* (CANTOR). Collecting & Breeding. 10 (3), pp. 72-74. (in Japanese).

They observe the development of Japanese loach by the artificial fertilization. They make a nomenclature of the embryology of Japanese loach, which is quite useful for the students' embryological experiment.

YAMAMOTO, TAKAHARU, 1948: On the Comparison between the Results of Some Different Methods of Calculating the Number of Ripe Ovarian Eggs of *Hypomesus olidus* (PALLAS), with Observations on the Asymmetry of its Gonad. Seibutsu 3 (3-4), pp. 128-130. (in Japanese).

The writer wished to know the difference in the total number of eggs in an ovary between the counting each by the finger and the count with a volmenometer. The result showed that the number counted with a volmenometer is somewhat larger than that by the finger. He also finds out an asymetry of the gonads in this species, the left more numerous than the right. The left gonad is much larger than the right.

YAMAMOTO, TAKAHARU, 1948: On the Number of Ripe Ovarian Eggs of the Pond Smelt *Hypomesus olidus* (PALLAS). Bull. Jap. Soc. Scie. Fish., 13 (4), pp. 150-152. (in Japanese).

The author makes experiments in the number of eggs of the pond smelt to the total length of body and to the body weight. He expressed in the formula that the relation between them is as follows. $N=aL^b$ and $N=a'W^{b'}$ where a, b, a′, b′ are constants specific to the kind of fish. The value of these constants calculated in the present species are $a=58.8\times10^{-5}$, $b=3.52$ and $a'=1.000$, $b'=0.967$.

1949

CHIHARA, TSUTOMU, 1949; Freshwater Fish of the Kino River. Ôsaka Hakubutsugaku Zasshi*, pp. 32-36. (in Japanese).

There are found 30 species of freshwater fishes in the Kino River, Ôsaka. The author described the habits of several species. A fact of *Acanthogobius flavimanus* (T. et SCH.) deposits eggs on *Zostera* sea weeds around June, is not yet mentioned since that time.

HATA, KYUZÔ, 1949: Effect of Light on the Hatching of Fish-egg. Bull. Jap. Soc. Sci. Fish., 15 (8), pp. 375-379. (in Japanese).

The author makes the experiments on several freshwater fishes in the effect of various rays. In the eggs of *Hypomesus olidus*, there is no effect on the rate of hatching when they are exposed in orange red and dark color rays, while other rays show good results. Blue color ray proves no good result and colorless ray is the worst. For the eggs of *Tribolodon hakuensis*, blue, orange and red colors produce good result. There is no difference in the rate of hatching among these three color rays. The dark color ray shows not a good result and the colorless ray is the worst. In the case of eggs of *Cyprinus carpio* and *Carassius auratus*, the author could not recognize any difference among the rates of hatching under those color rays. According to the different species and kinds of color rays, there are some difference in the average of days of hatching and mean variation of days of hatching. On the whole, however in the case of good percentage of hatching, the value of variation is small.

HIGASHI, KOJI, 1949; Fishes of the Yodo River. Ôsaka Hakubutugaku Zasshi, pp. 26-31. (in Japanese).

The writer surveyed the fishes of the Yodo River, Ôsaka and listed 53 species. He also mentioned the localitis and peculiar habits of these species.

ISHIKAWA, MASASHI and NAKAMURA, NAKAROKU, 1949: On the Breeding Habits and Development of a Goby, *Glossogobius brunneus* (T. et SCH.). Bull. Jap. Soc. Scie. Fish., 8 (6), pp. 365-366. (in Japanese).

The authors mentioned the breeding habit and development of a large common goby, *Glossogobius brunneus* (T. et Sch.) distributing from the coasts of tropic to central Japan. The material which was observed by the authors, was caught at brackish water pond of the Atsumi Fish Culture Company. The fish lives on the bottom in brackish or shallow water, hidden under stones or weeds. It spawns in summer, from the end of July to the beginning of September. The eggs adhere to the under surface of stones and they are guarded by the male, who aerates them by keeping out the flow of water over

* Ôsaka Hakubutsugaku Zasshi = Natural History Magazine of the Ôsaka Natural History Society, published by the Natural History Society of Ôsaka, Ôsaka.

the spawn through the action of his dorsal elongate and pyriform egg-shell which measures about 3.5 mm. in length. When the eggs are laid, a tuft of adhesive threads, with which they are attached in cluster to various objects, appears at the narrow and out of the shell-membrane. It seems like a minute branch of outer shell-membrane. The embryo is hatched out in 30 hours after the egg being spawned, at the water temperature of 26°C. The newly hatched fry measures about 2.07 mm. in total length. The favorable salinity for the normal development of the egg ranges from 10 to 22%cc.

KANOH, YASUHIKO, 1949: Under die Oekologie und Morphologie des japanischen Alands *Tribolodon* auf Hokkaidô. Seibutsu, 4 (3), pp. 81-89. (in Japanese).

The writer carries out this study around Utnaito and the River Ômu, Yufutsugun, Oshiri Province, Hokkaidô. The most interesting problems are ecology including spawning and development and morphology including a variation of many characters for classification. The writer identifies the systematic of this group including *Tribolodon hakuensis hakuensis* (G.), *T phalacrocorax* (J. et F.), *T. hakuensis ezoe* OKADA et IKEDA, *T. taczanowski* (ST.) by OKADA and IKEDA.

KAWAJIRI, MINORU, 1949: An Example of Pond Fish Culture and Multiplicationin the River of "Ayu". Bull. Jap. Soc. Scie. Fish., 15 (3), pp. 103-108. (in Japanese).

About 11-12 thousands marine fry of "Ayu" *Plecoglossus altivelis* T. et SCH. were reared since April 9th in a fish-culture pond, area 56 m^2, daily was given the food 9-10 times a day which was the mixture chiefly of barley 20-50%, rice-bran 20%, sild worm pupa 25-30%, sardin 30-60%, ground down with a masticator, At the beginning the ration increased according to the rising of the water temperature, but when the temperature was over 21°C (at 4 p.m.) the ration decreased, and when the temperature fell the ration increased again. The relations were 5% (dry weight) to the fish weight at the beginning, then for a time 7-8%, and shortly afterward descended to 2-3%. Ten fishes were measured weight 1-2 times per month, they grew slowly in S type curve as general fish, and the fishes were caught 9879 in number, and 893 kg. in weight at the end of September. On the multiplication of "Ayu" in the Chikuma River, in 4 years from 1939, the mean survival rate is 50-60%, mean product 577 kg. per 10 thousand fry, but it needed about 440 fishermen to catch them. After all, though the pond fish culture of "Ayu" needs much food, but this is certainly better for the ratio of survival and product, and less labour is needed to catch them in comparison with fish-trap, cast-net or angling in rivers. So, if there is no space enough to multiply "Ayu" in the river because of the fall of water for hydroelectric power plant or of the dangers from overstocking, it will be better to depend, indeed, upon the culture in the pond for the increase in the product of the fish, then to release the fry on an unprotected ground of river.

KAWAJIRI, MINORU, 1949: Influence of Population Density upon Reproduction on Killifish. Bull. Jap. Soc. Scie. Fish., 15 (4), pp. 166-178. pp. (in Japanese).

The author studies on the influence of the population density of Killifish (*Aplocheilus latipes*) upon the number of spawned eggs, hatching rate, and consequently on the reproduction. The experimented fish were cultured in pairs; to 4 pairs in 3 glass bowls the the eggs spawned respectively; counted 3-4 times every day, and transfered into each of the 3 glass bottles which were filled with water at the above ratio and also disinfected by 0.5% formalin every 4-5 days, and the fry hatched out were counted every day. Putting the results above mentioned, the number of eggs spawned by one female a day decreases, and besides the hatch-rate has a tendency of depression, proportion to the population density of the fishes increases, and by the accumulation of these factors the rate of reproduction of the fish found decreasing. Satisfied is the equation $y=ax^b$, where y represents the number of eggs spawned by per 1 female a day, or hatching-rate, x density of population, a and b are the characteristic constants.

MATSUI, KIZÔ, 1949: Illustration of the Normal Course of Development in the Fish, *Oryzias latipes*.

Zikken-keitai Gaku* 5, pp. 33-34. (in Japanese).

The writer treats the developmant of the present species *Oryzias latipes* and describes segmentation, morular stage, blastular stage, differentiation of embryo, somites, circulatory system, caudal growth, the pectoral fin appearance, mouth part development, and hatching out.

MATSUI, YOSHIICHI, 1949: On the Variation of Characters in the Carp of Japan. J. J. I., 24 (1), pp. 26-28. (in Japanese).

We have several varieties of Japanese carp in the color and scale. The typical species has a black cycloid scale but has many variations in the ratio between body height and body length. In the case of breeding races, this ratio of body heigth and body length is 1 : 2.4-3.4, and in the natural ones it is 1 : 3.2-4.8. The body heigth race is produced in case of lower water-temperature and good nourishment. He wishes to study the local variations of carp in various different environmental ponds.

NAKAMURA, MORIZUMI, 1949: *Gnathopogon elongatus caerulescens* in Biwa Lake and the Fisheries. Collecting & Breeding, 11 (3), pp. 79-82. (in Japanese).

The writer already published paper on the life history of *Gnathopogon elongatus caerulescens*, in the Bull. Jap. Soc. Fish., (14-6). The present report is rather popular, including almost all kinds of the fishing used in Lake Biwa.

NAKAMURA, MORIZUMI, 1949: The Life History of a Cyprinid Fish, *Gnathopogon elongatus caerulescens* (SAUVAGE) in Lake Biwa. Bull. Jap. Soc. Sci. Fish.,15 (2), pp. 88-96. (in Japanese).

The author makes a reseach on the life history of *Gnathopogon elongatus caerulescens* (SAUVAGE)**, one of the most important edible fish in Lake Biwa. It lives in rather deep waters and spends winter at the lake bottom of 80-90 m. deep. In the breeding season, the pearl organs appear in both sexes, more distinctly in male. The young and adult feed mainly on zooplankton, except in winter. The author finds out the alimentary canal empty during the winter. From April to June, they come up to shallow waters and enter inlets or creeks, and then lay eggs on the leaves of water plants or roots or willow trees. Female spawns three or four times. The total number of eggs is ranged from 395-7900, related to body length and weight of the fish respectively. The eggs are adhesive and spherical, measuring 1.3 x 1.5 mm. in size, semitransparent with minute wavy sculpture on the surface. Eggs hatch in about 8 days at the water temperature 20°C. The just-hatched-out larva measures 4.3-4.8 mm. in total length. In natural, they attain 94 mm. in male and 95 mm. in female in the first year, to 113 mm. and 116 mm. in the second year, and to 123 mm. and 128 mm. in the third year. They become mature after one year and dimorphic in sexes; the male smaller than the female.

NATÔ, MINORU, 1949: Hatching and Breeding of "Ayu" (*Plecoglossus altivelis*) by the Water of Hot Spring. Bull. Jap. Soc. Sci. Fish., 15 (8), pp. 431-438. (in Japanese).

The author makes an experiment on the feeding of plankton produced in the pond of Suwa Hot Spring, Nagano Prefecture. The water temperature of the pond keeps 18°C or higher, the plankton is produced aboundantly. The larvae of about 10 mm. in body length come up to the surface of pond and when they are 14 mm. or larger, they take the zooplankton and 23 mm. youngs can be fed artificially. Larvae hatched out in November, attain about 4 gr. in weight next April.

SATÔ, MITSUO, 1949: On the Pit Organs of the Catfish, *Parasilurus asotus* L. Bull. Jap. Soc. Sci. Fish., 15 (6), pp. 272-276. (in Japanese).

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* Zikken-Keitai Gaku = Journal of Experimental Zoology published by the Japanese Society of Experimental Zoology, Tôkyô.

** This subspecies resembles *G. elongatus elongatus* (T. et SCH.), but differs from it by slender form, having more numerous gillrakers, shorter barbels and a rather anteriorly situated dorsal fin.

The author studies on the histological structure of the pit organs of a Japanese catfish, *Parasilurus asotus*. Generally the pit organs are divided into two kinds, larger and smaller ones. The larger pit organs are commonly detected by the naked eye examination on account of the absence of pigmentation around them. They are arranged on the head and trunk in difinite lines. The specific sensory cells or pear-shaped cells are crowded closely in the narrow outer portion of the organ. The small pit organs are freely scattered over almost the whole body surface. The pear-shaped cells are found much larger than those of the larger pit organs. The organ sinks below the surface of epidermis and communicates with the surface by an elongated, minute pore.

1950

HERVEY, GEORGE, 1950: The Gold-fish of China in the XVIII Century. China Society, London, pp. 1-66.

This is a small book concerned to the gold-fish in China. The author mentions the gold-fish of China in the XIII century and Kin-yu ou Poisson Dorê, Dorade de Chine. In fine he listed up Chinese names and words.

HOTTA, HIDEYUKI, 1950: On the Number of Mature Ovarian Eggs of *Salangichthys* in Japan. Bull. Jap. Soc. Sci. Fish., 16 (8), pp. 363-366. (in Japanese).

The author declares that the relation between the number of the mature ovarian eggs (N) of *Salangichthys microdon* (BLEEKER) and *S. ishikawai* W. et T. and the body length (L) or the body weight (W) can be expressed in the formula $N\text{-}aL^{b}$ or $N=a'W^{b'}$, where a, b, a′ and b′ are constants. The values of the constants were calculated from the present specimens as follows: (A) for *Salangichthys microdon* (BLEEKER), a=0.1890, b=4.130, b′=6.208, and a′=654.8, b′=1.8265.

KANOH, YASUHIKO; 1950: General Aspects of early Development of *Tribolodon hakuensis hakuensis* (GÜNTHER). J. J. I*., 1 (2), pp. 116-123. (in Japanese).

The author made the observation on the normal early development of Japanese Dace. He has described the details with many fine illustration.

KAWAMOTO, NOBUYUKI, 1950: The Influence of Sex Hormones on the Reproductive Organ of Sôgyo "*Ctenopharyngodon idellus* (C. et V.). J. J. I., pp. 1 (1), 8-16. (in Japanese).

The author made the experiments on the ovulation of *Ctenopharyngodon idellus* (C. et V.) by supplying the food contained the hydrosal of androsteron and Esteron during 9 years. These experiments were carried out in the Nakamura Farm at Hikone City, Shiga Prefecture. He imported about 150 fishes from China by the courtesy of the Shiga Prefectural Fisheries Experimental Station for his research. He succeeded the maturation of gonads by giving hormones through the mouth with food processed. But the artificial fertilization is still unsuccessful. The breeding season occurs from April to July at Hikone, Shiga Prefecture and during this period, the pearl organs appear on the surface of the male fins. The author concluded that it was wise and proper for the propagation of *C. idellus* to set free the fishes after sexual glands had fully grown as the result of hormones given in the test pond.

KAWAMURA, TOSHIJIRÔ and MOTONAGA, TAEKO, 1950: On Artificial Ovulation in the Spinous Loach. J. J. I., 1 (1), pp. 1-7. (in Japanese).

The authors have made the experiments and observations on the artificial ovulation in the spinous loach. The materials of the experiments were mostly *Cobitis taenia striata* from around Fukuyama City, Hiroshima Prefecture and Tottori Prefecture as well as *Cobitis biwae* from around Hiroshima City, Hiroshima Prefecture. The spinous loaches were injected with frog pituitary suspension during

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* J. J. I. = Japanese Journal of Ichthyology, published by the Ichthyological Society of Japan, Tôkyô.

the breeding season. They observed microscopically the changes in the ovarian eggs after the injection, by the sections of fixed material. Yolk granules surrounding the germinal vesicle begin to dissolve two hours after the injection. The germinal vesicle moved towards the animal pole one hours later. At the fifth hour after the injection it disappears and all of the yolk granules contained in the egg show a tendency to become larger by fusion with neighboring ones. At that time, the eggs begin to become semi-transparent. The first maturation spindle was observed in the eggs which were fixed six hours after the injection. The metaphase spindle of the second maturation division is formed one hour later. About that time ovulation begins to occur in the spinous loaches. The unfertilized eggs shed into water give off the second polar body and form the female pronucleus in the egg just like fertilized ones. When fragments of the ovaries of spinous loaches are immersed the fragments cleaved normally after insemination.

KAWAMURA, TOSHIJIRÔ and ÔTSUKA, SOTOJI, 1950: On Acceleration of the Ovulation in the Gold-fish. J. J. I., 1 (3), pp. 157–163. (in Japanese).

The author made the experiment on the acceleration of the ovulation in the gold-fish and red crucian carps by the injection of hormone gonadotropic substances. The examined specimens are the 10 months aged fishes after hatching out. The hormone gonadotropic substances are manufactured by Teikoku-Zôkiyaku Kenkyûsho. He also used a frog or cattle anterior pituitary suspesions for injection. The results are as follows. The ovulation was accelerated by injection of several kinds gonadotropic substances into female gold-fishes with full-grown ovaries. By mateing, spawning occurred 1–3 days after injection of more than 4 frogs or fowls pituitary glands, 100 gm. of dried cattle anterior pituitary grands or 150 RU of gonadotropic. When the injected females were not mated, the ovulation was weaker than that in the mated females, though their ovaries were affected and ovulated some completely or partly ripened eggs by injection of nearly the same amount of the gonadotropic substances. The proportion of hatched larvae to artificially fertilized eggs was nearly the same between the ovulation under natural conditions and the artificial one which was accelerated with gonadotropic substances. It was about 80% in most cases. While the breeding season of the gold-fish in April to July, one female reared at high temperature and under prolonged illumination laid eggs on March 3. Another female which had been injected with gonadotropic substances far a long time ovulated ripe eggs on September 13.

KOBAYASHI, SHIGEO; YAMANAKA, YUTARÔ and TORII, RISHICHI, 1950: Spawning Habit of *Chaenogobius isaza* TANAKA (Preliminary report); Bull. Jap. Soc. Sci. Fish., 15 (12), pp. 808–812. (in Japanese).

The three authors studied the life history of endemic Goby, *Chaenogobius isaza* TANAKA distributed in Lake Biwa. The spawning habit is mostly mentioned in the present report. In spring, the goby spawns in the shallow and gravel-bottomed waters along the north coast of Lake Biwa. Females lay their eggs in a mass on the flat and smooth lower surface of gravels. After the deposition of eggs, a male guards them until the hatching out. The eggs is oblong, measured 1.5–1.6 × 0.5–0.7 mm. in size. The egg-masses, measured 20–30 cm. in size, circular or elliptical in outline, composing of 33–997 eggs. The eggs hatch out in 152 hours at the water temperature of 16–19°C and in 115 hours at 16–32°C. The newly hatched out larva is 3.06 mm. in body length with 30 myotoms. Young fish attains 16 mm. in length, in the late of June, 27mm. in August, 30 mm. in October.

KOYAMA, HAJIMU, 1950: Ecological Studies of *Cottus pollux* GÜNTER in Chikuma River. 1. On Living Condition and Breeding Habits. Bull. Jap. Soc. Fish., 16 (1), pp. 119–126. (in Japanese).

The author finds that *Cottus pollux* GÜNTHER is unable to live in some parts of the Chikuma River on account of the pollution or of the water force. This species breeds in the river during early February to the middle of May. The water temperature in these months changes from 4°C to 10.5°C at 10 a.m. of the day. The eggs are laid under a flat stone in the current stream. The number of the eggs of a fish is about 300, according to the size of fish. The diameter is 2.9–3.3 mm. in average and

the color is light orange. It breeds about three times during the season.

KUSA, MAMORU, 1950: Physiological Analysis of Fertilization in the Egg of the Salmon, *Oncorhynchus keta.* 1. Why are the Eggs not fertilized in Isotonic RINGER's Solution? Ann. Zool. Jap., 24 (1), pp. 22–28.

The writer reported the result of the experiment in which the salmon egg is readily activated upon immersion in water: while the egg is not activated merely by the penetration of the effective spermatozoon. He considered two important factors for the fertilization of salmon eggs. One is the entry of the spermatozoa and second is the activation of the egg itself. The egg is not activated, and apparently cannot be fertilized in consequence, as long as it remains in either isotonic RINGER or its own egg fluid. The activation of the egg by water is inhibited in proportion to the amount of salts contained, but non-electrolytes, such as sucrose and urea appear to have no such inhibitory action, at least, in so far as isotonic and hypotonic concentrations are concerned.

KUSA, MAMORU, 1950: A Preliminary Note on the Fertilization in the Egg of Salmon (*Oncorhynchus keta*). Zool. Mag., 59 (10), pp. 240–241. (in Japanese).

The writer makes some experiments for the artificial fertilization of Salmon. Salmon eggs have certain marked peculiarities in regard to fertilization. The eggs inseminated in isotonic RINGER solution cannot become fertilized, however, when reimmersed in water, they can be fertilized. In water the eggs are readily activated without spermatozoa and fertilization is arested as the activation proceeds, but no further development takes place. The salt contained in the RINGER solution probably acts as a temporary stopper of the egg activation, while non-electrolytes such as urea and sucrose, will produce no such retarding effect. Thus concluded, in the fertilization of salmon eggs two factors are involved: one, the entrance of spermatozoa and the other, the activation of egg itself. Parenthetically, in the RINGER treatment, it is found that in eggs inseminated in isotonic RINGER the polyspermic cleavage is permitted with a certain rise to monospermy, if they are washed with isotonic solution of NaCL or Ca-free RINGER and again inseminated in water.

MATSUI, ISAO, 1950: On the Morphological Dissimilarity of "Ayu" (*Plecoglossus altivelis*) in the Circumstantial Difference, Sex and Scales Circuli, and the Discrimination of "Pond-cultured Ayu" and "Natural Ayu". J. J. I., 1(1), pp. 17–24. (in Japanese).

With the liberation of fry and propagation of "Ayu", deciding morphological characteristics between Natural "Ayu" and Pond-cultured "Ayu", its great commercial value, protection and conservation of "Ayu". The differences of growth in the locality, forms an interesting data for his reseach. The author has found the differences between two forms as follows.

1. Body breadth of pond-cultured "Ayu" is wider than that of natural "Ayu".
2. Body height of female natural "Ayu" is rather higher.
3. Ventral and anal fins of female pond-cultured "Ayu" are located somewhat forwards.
4. The height of anal fin of pond-cultured "Ayu" is larger.
5. Head length of male natural "Ayu" is longer.
6. The spot of female pond-cultured "Ayu" located forwards.
7. The scales, coefficient of natural "Ayu" is smaller than the pond-cultured "Ayu".

MATSUI, ISAO, 1950: Studies on the Growth of the Pond-cultured Animals. V. On the Growth of "Tobi-koi" (superior growing carps' group). J. J. I., 1 (3), pp. 166–174. (in Japanese).

The author called a very superior group of carp which has a very rapid growth and largest of all, "Tobi-koi" in 1949. He has treated the growth rate of this superior group from the special characteristics of growth rate. The body-length of this group exhibits a minimum of 5.9 cm., maximum. 15.5 cm., average 9.06 ± 0.31 cm. in lst year, minimum 19.66 cm., maximum 33.0 cm., average 25.77 ± 0.26 cm. in second year, minimum 34.6 cm., maximum 45.4 cm., average 40.01 ± 0.66 cm. in third year. The growth rate of male is superior than female during the lst, but in second year female is somewhat

superior to male, and in third year female is more superior to male. This irregular phenomenon is probably attributable to the development of gonad. From these facts, he concluded that the growth rate is superior by 5% in one year, 3% in two year, about 5% in three years comparing with that of common carp group.

MINAMORI, SUMIO, 1950: Isolating Mechanisms in the Striated Spinous Loach, *Cobitis taenia striata* Jour. Sci. Hiroshima Univ*., Ser. B, Div. 1, vol.11, Art. 7, pp. 55–59.

The writer studies the local variations of spinous loaches (*Cobitis taenia striata*), in the south-western district of Honshû. He has investigated the local varieties occurring in this group by means of hybridization experiments during several years. He also found that some of he hybrids of these local races were sterile.

NAKAMURA, MORIZUMI, 1950: The Life History of a Cyprinid Fish, *Ischikauia steenackeri* (SAUVAGE) in Lake Biwa. Bull. Jap. Soc. Sci. Fish., 15 (12), pp. 833–840. (in Japanese).

The author studies the life history of *Ischikauia steenackeri* (SAUVAGE) which is quite an endemic cyprinoid fish in Lake Biwa. This is distributed widely in Lake Biwa. The adult of the fish is mostly found in shallow waters and feeds on water plants. During the breeding season this male has pearl organs on the dorsal part of the head and body, around the eyes, preopercle, lower jaw and the inside of pectoral rayer. The females also have very small pearl organs on pectorals only. They deposit eggs on aquatic plants and the roots of a willow tree. The number of eggs ranges from 2,500 to 140,000. The egg is adhesive, spherical in shape and 1.24–1.31 mm. in size. The egg membrane is thin and transparent; the yolk is bright yellowish green and granular with as few small oil globules. The egg hatches out in about 3 days in the water at the water temperature ranging 22–24°C. Newly hatched larva measures 4.6 mm. in total length. The larva 24 hours after the hatching out attains 5.0 mm. with numerous filamentous tubercles on laterals of the body as is seen in *G. elongata caerulescens* (SAUVAGE). The larvae are found completely absorbed of their yolk-sac 6 days after the hatching, and feed on small zooplankton such as *Rotifera* and *Cladocera*. The fish seems to grow about 50–100 mm. in the first summer, 150–200 mm. in the next and become mature, and after that it grows very slowly.

OKADA, YAICHIRÔ and SUKÔ, TETSUYA, 1950: Freshwater Fishes of the Arakawa River, Chichibu, Saitama Prefecture. Rep. Chichibu Nat. Hist. Mus**., No. 2, pp. 107–110. (in Japanese).

The writers described 21 species of freshwater fishes collected at several of the Arakawa River, Chichibu, Saitama Prefecture. They are included under nine families, 20 genera. The writers also discussed on the vertical distribution of these fishes. *Salvelinus pluvius* is distributed only in the upper part of the river and *Oncorhynchus masou, Cottus pollux, Salvelinus fontinalis* are also distributed somewhat lower to the upper part of the river. In the middle part of the river, we found *Anguilla japonica, Pseudogobio esocinus, Tribolodon hakuensis*, and *Zacco platypus*.

ROKUYAMA, MASATAKA, 1950; *Ophicephalus* in Nara Prefecture. Kansai Shizenkagaku Kenkyûkai Kaishi*** ,4, p. 11. (in Japanese).

The author confirmed the scientific name of *Ophicephalian* fish found in Nara Prefecture as *Ophicephalus argus* and named it as "Hebigashira" instead of Taiwan dozyô in Japanese.

SAITÔ, SABURÔ, 1950: The Embryological Study of Fishes. 1. General Observation on the early Development of the Dog Salmon *Oncorhynchus keta* WALBAUM. Joun. Fac. Agr. Hokkaidô Univ., vol. 43, 3, pp. 207–289.

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* Jour. Sci. Hiroshima Univ. = Journal of Science, Hiroshima University published by the Faculty of Science, Hiroshima University. Hiroshima.

** Rep. Chichibu Nat. Hist. Mus. = Report of Chichibu Natural History Museum published by the Chichibu Natural History Museum, Chichibu, Saitama Prefecture.

*** Kansai Shizenkagaku Kenkyûkai Kaishi = Bulletin of the Kansai Natural History Society published by the Kansai Natural History Society, Ôsaka.

The writer describes the nomenclature of the normal development of *Oncorhynchus keta* WALBAUM in this report. The resistance of the Teleostean egg to the mechanical treatment and chemicals varies with the developmental stages. These facts should be an intimate connection between the developmental degree of organs and the vitality of the egg.

SATÔ, RYÛHEI, 1950: Biological Observation on the Pond Smelt, *Hypomesus olidus* (PALLAS), in Lake Kogawara, Aomori Prefecture, Japan. 1. Habits and Age composition of the Spawning Fishes. Tôhoku Journ. Agric. Resear*., 1 (1), pp. 87-95.

The writer reports a synthetic observation on the spawning habits of pond smelt, carried out in Lake Kogawara and its adjacent waters. He concluded as follows. Both the fishes living in the lake and those ascending from the sea belonged to the same race. The latter seemed annually to ascend the Takase River as far as Lake Kogawara, from the sea near by, before their spawning season came and to merge in the groups of many other land-locked smelts already inhabiting the lake. Schools of the pond smelt first moved from the depth of the lake to join some schools along its borders just before their maturity, and then settled in their spawning grounds, such as sandy shoals or clear streams, in full maturity within several days. The pond smelt spawned in shoals around the lake, and the ova attached to the leaves and stalks of hypophyses on the sandy bottom of the depth of 3-4 meters. Some of the pond smelts ascended from the lake to the streams and there the ova attached to pebbles, sand and shells. The testcounts showed a maximum of about 10,000 ova per 100 sg. centimeters in the spawning grounds of the Anedo stream on April 2, 1948. The spawning of these pond smelts in the lake took place during the time from late March to the middle of April, when the ice covering the surface of the lake had been melting.

SATÔ, RYÛHEI, 1950: On Feeding Habits of the Larva of Pond Smelt, *Hypomesus olidus* (PALLAS). Tôhoku Journ. Agric. Resear. 1 (2), pp. 215-222.

The Pond Smelt, *Hypomesus olidus* is one of the most important land-locked fish in the inland water of Japan. It is fished commercially in such lakes as Abashiri, Kagawa, Hachirô-gata, Kasumiga-ura, Shinji and others. As it has a high adaptability to various environmental conditions, it can be transplanted easily from one water to all over Japan. The pond smelt reaches the adult stage and spawns at the end of one year after hatching. One of the difficult questions was to rear the early larvae of pond smelt in a smelt pond, because the favorite food of young larvae was unknown. The writer succeeded in rearing them in a small pond on planktonic organisms in to the average size of 20.9 mm. in total length. *Navicula* sp. *Coscinodiscus* sp. *Scenedesms* sp. *Chlamydomonas* sp. and non-colored naked *Flagellate* are themselves not suitable as food. It was proved that Zooplanktons such as *Brachionus bakeri* and nauplius larvae of *Cyclops* sp. are a favorite food for the very early larvae fish. As the larvae grow, other food organisms such as *Cladocera*, *Bosmia coregoni* and *Moina macropora*, and a copepod, *Cyclops* sp. may replace the *Rotifers*.

SATÔ, RYÛHEI and SUGANAMI, SHINICHIRO, 1950: The Artificial Rearing of Larval Fish of *Tribolodon* sp. Bull. Jap. Soc. Sci. Fish., 16 (1), pp. 21-24. (in Japanese).

The two authors tried an experiment of the artificial rearing of larval fish of *Tribolodon* sp. at the Onagawa Fisheries Laboratory of Tôhoku University. They collected the adult and artificially fertilized around the mouth of the River Shichinohe, on the coast of the Lake Kogawara in Aomori Prefecture in June, 1947. Then the fertilized eggs were transported by train to the Onagawa Fisheries Laboratory. The eggs were kept in glass-vessels with the capacity of 1 litre and used as materials for artificial culture. Experimental results are as follows. 1). The pre-larval fish, which had hatched out on the 7th to the 9th days after fertilization at 14-17°C., grew without food supply and reached about 11 mm. length in 11-13 days. 2). The post-larval fish, having nearly absorbed of their own yolks and grown

* Tôhoku Journ. Agric. Resear. = Tôhoku Journal of the Agriculture Research Institution published by the Agriculture Department of Tôhoku Imperial University, Sendai, Miyagi Prefecture.

up about 10 mm. in length, could be fed with artificial food, fish meal and egg-yolk of chicken. 3). After the post-larval fish had acquired some growth, they took a zooplankton, *Moina macrocopa* as well as the artificial food. This plankton was one of the most available food for the fish in this stage.

TAKAGI, KAZUNORI, 1950: On the Glossohyal Bone of the Gobioid fishes of Japan, with some phylogenetic Considerations. J. J. I., 1 (1), pp. 37-52. (in Japanese).

The author considerd the phylogenetic on the gobioid fishes of Japan with the characteristics of glossohyal bone. He divided 47 species into two large groups by the characteristics of glossohyal bone. Types - G 1 has a simple bar-or fan shaped bone with convex anterior border, embracing 30 species, (occupying 63.8% of the fishes examined). Types G 2 is divisible into 3 subtypes, namely Type E, Type F, and Type L. Type E included 4 species, Type F 10 species and Type L 3 species. The group G 1 is taken to be primitive compared with the other one. Group E which links group G and other 2 groups of group-G 2: group F and L, seems to arise from the zonoleucus group of the group G 1, for the bone of this group bears much resemblance to that of the zonoleucus group. Then the 2 groups, F and L, diverge from this group. From these observations, he concluded that the Japanese gobies must be included under the same family, Gobiidae, as JORDAN and SNYDER and eight subfamilies.

YAMAMOTO, KIICHIRÔ, 1950: On the Factors for Developmental Initiation in the Egg of the Dog Salmon *Oncorhynchus keta* WALB. Physiology*, 4 (1), pp. 21-28.

The author makes experiment for the Dog Salmon which has been inhibited in the natural water from the fertilization and knows a mechanism of this fact. The dog salmon's eggs inseminated in 1/7 balanced salt solution do not form the blastodisc nor do the yever cleave, although the spermatozoa actively move and the eggs retain their fertilizability for a long time in that medium. From this experiment he may suppose that the development of egg is not initiated or that the developmental processes are inhibited in that medium. When the eggs have been by dry method are immersed into tap water for a short time and then transferred into the 1/7 b. s. s, the cleavage readily occurs. He concluded that the failure of the fertilization depends on the lack of the developmental initiation and that the conditions of the medium play an important rôle for the developmental initiation. Of the conditions of the medium, the concentration of the ions is most responsible for the initiation of the egg and their critical concentration is to be less than that of 1/10 b. s. s.

YANAI, RYUICHI, 1950: Fishes of Sanin. Zool, Mag., 59 (1), pp. 17-22. (in Japanese).

The writer collected 353 species of marine and freshwater fishes, of these, here 35 species of freshwater fishes are listed up.

Petromyzontidae:
1. *Lampetra fluviatilis japonica* (M.).
2. *L. planeri* (BLOCH).

Acipenseridae:
3. *Acipenser* sp.

Salmonidae:
4. *Oncorhynchus keta* (WALBAUM).
5. *O. milktschisch* (WALBAUM).
6. *O. m. macrostomus* (GÜNTHER).
7. *Salvelinus malma leucomaenis* (PALLAS).
8. *Plecoglossus altivelis* (T. et SCH.).

Osmeridae:
9. *Hypomesus olidus* (BREVOORT).

Salangidae:
10. *Salangichthys microdon* (BLEEKER).

Siluridae:
11. *Parasilurus asotus* (L.).
12. *Pseudobagrus aurantiacus* (T. et SCH.).
13. *P. nudiceps* (SAUVAGE).

Cobitidae:
14. *Misgurnus fossilis* (L.).
15. *Cobitis taenia* L.

Cyprinidae:
16. *Rhodeus tabira* (J. et THOPMSON).
17. *Rh. intermedius* (T. et SCH.).
18. *Sarcocheilichthys variegatus* (T. et SCH.).

* Physiology and Ecology = Journal of Physiology and Ecology published by the Zoological Institute of Kyôto Imperial University, Kyôto.

19. *Pungtungia hilgendorfi* (ISHIKAWA).
20. *Pseudorasbora parva* (T. et SCH.).
21. *Leuciscus hakuensis* GÜNTHER.
22. *Phoxinus steindachneri* SAUVAGE.
23. *Zacco platypus* (T. et SCH.).
24. *Zacco temmincki* (T. et SCH.)
25. *Ischikauia steenackeri* (SAUVAGE).
26. *Cyprinus carpio* L.
27. *Cyprinus carassius* L.

Flutidae:

28. *Fluta alba* (ZUIEW).

Anguillidae:

29. *Anguilla japonica* T. et SCH.

Cyprinodontidae:

30. *Oryzias latipes* (T. et SCH.).

Mugilidae:

31. *Mugil cephalus* L.

Serranidae:

32. *Lateolabrax japonicus* (CUV. et VAL.).

Gobiidae:

33. *Mogurnda obscura* (T. et Sch.)
34. *Acanthogobius flavimanus* (T. et SCH.).
35. *Tridentiger obscurus* (T. et SCH.).

YASUDA, HIDEAKI and KOIKE, ATSUSHI, 1950: Growth of Japanese Principal Fish II. *Lateolabrax japonicus* (C. et V.). Bull. Jap. Soc. Scie. Fish., 16(6), pp. 256-258. (in Japanese).

The author studied the growth of Japanese principal fish *Sardinia melanosticta* (T. et S.), *Taius tumifrons* (T. et S.). Here the brackish water fish *Lateolabrax japonicus* is mentioned on the growth. The resting zone of the scale seems to be formed during June to Augast in rather young specimens measured 21cm. in length, in which the scales are provided with 1 or 2 resting zones. But this fact is not ascertained yet in the specimens larger than those given above. The growth obtained from the scale analysis differs by localities from which the materials are taken, namely the fish of Tôkyô Bay growth and its adjacent waters is slower than that of the fish secured from the Inland Sea Harimanada, but larger than that of the fish taken from Sanriku, Pacific side of Japan. Whilst the average body lengths led from the back, calculation based on scale are as follows, $l_1=21$, $l_2=32$, $l_3=42$, $l_4=50$, $l_5=55$ cm.

1951

HIKITA, TOYOHIKO, 1951: Fishes of Volcano Bay in Hokkaidô. J. J. I. 1 (5), pp. 306-313. (in Japanese).

This report is based on fishes obtained by the writer at the environs of the Volcano Bay, Hokkaidô for years. The writer listed 116 genera and 141 species in those of which, the freshwater and brackish water species were included as follows.

1. *Lampetra japonica* (MARTENS).
2. *Oncorhynchus keta* (WALBAUM).
3. *Oncorhynchus masou* (BREVOORT).
4. *Oncorchynchus gorbuscha* (WALBAUM).
5. *Salvelinus lecoumaenis* (PALLAS).
6. *Plecoglossus altivelis* (T. et SCH.).
7. *Osmerus dentex* (STEINDACHNER).
8. *Spirinchus lanceolatus* (HIKITA).
9. *Hypomesus olidus* (PALLAS).
10. *Hypomesus japonicus* (BREVOORT).
11. *Salangichthys microdon* (GÜNTHER).
12. *Leuciscus hakuensis* (GÜNTHER).
13. *Gasterosteus aculeatus aculeatus* (LINN.).
14. *Hemirhamphus sajori* (T. et SCH.).
15. *Tridentiger obscurus* (T. et SCH.).

ISHIDA, JURÔ, 1951: Effects of 2.4- Dinitrophenol on Oxygen Consumption during early Development of the Teleost, *Oryzias latipes*. Ann. Zool. Jap., Vol. 24, no. 4, pp. 181-186.

The author made the study on the effect produced by 2.4-dinitrophenol on the oxygen consumption of the cleaving egg of the *Oryzias latipes* at various stages, as part of a general study on the metabolic changes found during embryonic development in the fish egg. He summarized that the oxygen consumption of the cleaving eggs of *Oryzias* rose to a maximum at a concentration of M/9,000–M/10,000 2,4-dinitrophenol cleavage to closure of the blast pore during two or five hours. Embryos which had been allowed to develop normally in tap water until the optic vesicle stage and thereafter exhibited little or no increase in oxygen consumption. The rise of the oxygen consumption coincides

with a retardation of embryonic development, depending upon the concentration of 2.4-dinitrophenol and the stage of the dividing eggs.

ISHIYAMA, REIZÔ, 1951: Revision of the Japanese Mugilid-Fishes, especially based upon the Osteological Characters of the Cranium. J. J. I., 1 (4), pp. 238-250. (in Japanese).

The writer made detailed studies on the cranium and visceral skeletons of five species of the Japanese Mugilid-fishes referred to three genera, *Mugil*, *Liza*, and *Chelon*. From his study the osteological characters provide more clear specific and genetic criteria and also more reliable indication of phyletic relation than the older schemes which based essentially on the external configurations. He has announced the genus *Chelon* is a most differntiated representative of Japanese Mugilids, having the remarkable basioccipital processes and peculiar shape of premaxillary. The genus *Mugil* is unquestionably more differentiated than the others in lacking both the basisphenoid and ethmoid, a pair of long posterior projection of urohyal, and three remarkable articular processes on post-temporal. The third genus *Liza* also more specialized than the genus *Chelon* at least in having peculiary elongated posterior-zygapophysis in second vertebra, well developed ethmoid, three articular process on post-temporal, and in lacking the posterior opening in myotome, although premaxillary less developed than in the latter. Therefore, the present genus seems to be rooted very deep in phylogeny within this group.

KOBAYASHI, HIDESHI, 1951: Experimental Studies on the Sexual Characters of the Loach, *Misgurnus anguillicaudatus* (CANTOR). Ann. Zool. Jap., vol. 24, no. 4, pp. 212-21. (in Japanese).

The author made many experiments affecting the sexual characters of the loach. The pectoral fin of the male regenerated after the castration is of the female type. In castrated male fish, the pearl organs and the swellings of the dorso-lateral region of the body just posterior to the dorsal fin never appear. Following the implantation of pellets of methyl-dihydro-testosterone in the female, the pectoral and abdominal fins are transformed into fins of the male type, and the pearl organs are also enlarged as in the male. On the lateral swellings of the experimental females, the epidermis becomes thickend as in the male and contains many mucous cells and flask cells. Oestriol pellets implanted in the male inhibit the appearance of pearl organs and lateral swellings.

KOBAYASHI, HISAO, 1951: Notes on the Clasification of Japanese Loaches. Collecting & Breeding, Vol. 13, no. 8, pp. 245-249. (in Japanese).

The author described 7 species belong to the family Cobitidae in Japan with local names and foreign common names.

1. *Misgurnus anguillicaudatas*. Madojyô – Loach, Japanese pond loach, Thunder fish.
2. *Cobitis taenia striata*. Shimadojyô – Striped loach, Spinous loach, Spined loach.
3. *Lefua echigonia*. Hotokedojyô – Budha loach.
4. *Cobitis taenia*. Tairikuhotokedojyô – Kessler's loach.
5. *Lefua nikkonis*. Ezohotokedojyô – Ezo Buddha loach.
6. *Barbatula toni*. Fukudojyô – Stone loach, secondary loach.
7. *Hymenophysa curta*. Ayumodoki –

He added the keys of this group at final.

KOBAYASHI, HISAO, 1951: On the Value of Scale Character considered as Materials for the Study of Affinity in Fishes. J. J. I., 1 (4), pp. 226-237. (in Japanese).

The writer believes that the scale character shows definitely a certain affinity, between genera, families or large groups. He shows some examples on Cobitid Fishes including five genera according to their scales. The differences of species between "Yamame", a land-locked form of *Oncorhynchus masou* and "Amago", or *Oncorhynchus rhodurus* has been a long disputed problem but the bitter dissimilarity between the two in scale character proves that their affinity is not so near in spite of the similarity of their outer appearances, as shown by Dr. M. OSHIMA.

KOBAYASHI, HISAO, 1951: On the Scales of the Hybrid of *Cyprinus carpio* and *Carassius auratus*. J. J. I., 1 (5), pp. 300–303. (in Japanese).

The writer has distinguished the scales of the hybrid between *Cyprinus carpio* and *Carassius auratus* by the characteristics of the scale configurations. The ordinary scale of the hybrid indicates an intermediate type in scale character.

KUBO, IZUO and SAKURAI, HIROSHI; 1951: Some Measurements and Counts on a freshwater Fish, *Aplocheilus latipes* (T. et SCH.). J. J. I., 1 (5) ,pp. 333–346. (in Japanese).

The authors made some biometrical observations on *Aplocheilus latipes* (T. et SCH.). 236 specimens were obtained at Kurihama, Kanagawa Prefecture. They made the measurements and counts body-length, body-weight, length of fins, number of circuli, weight length relationship, relative growth of fins to the body-length, relevance between number of the circuli and body-length and that between the number of the circuli and the age of the fish.

KURODA, NAGAMICHI, 1951: Anominal List with Distribution of the Fishes of Suruga Bay, inclusive of the freshwater Species found near the coast. J. J. I., 1 (5), pp. 314–338; Vol. 1. No. 6, pp. 376–394. (in Japanese).

The writer listed up 708 species of marine and freshwater fishes around Suruga Bay, Shizuoka Prefecture in the central part of Japan. The freshwater fishes are as followings.

1. *Eptatretus burgeri* (GIRARD).
2. *Salmo rhodurus* (JORDAN et MCGREGOR).
3. *Plecoglossns altivelis* (T. et SCH.).
4. *Salangichthys microdon* (BLEEKER).
5. *Aplocheilus latipes* (T. et SCH.).
6. *Parasilurus asotus* (LINN.).
7. *Gnathopogon elongatus elongatus* (T. et SCH.).
8. *Pseudorasbora parva* (T. et SCH.).
9. *Leuciscus hakuensis hakuensis* (GÜNTHER).
10. *Phoxinus steindachneri* (SAUVAGE).
11. *Zacco platypus* (T. et SCH.)
12. *Hemigramocypris rasborella* (FOWLER).
13. *Carassius carassius auratus* (LINN.).
14. *Cyprinus carpio* (LINN.).
15. *Misgurnus fossilis anguillicaudatus* (CANTOR).
16. *Lefua echigonia* JORDAN et RICHARDSON.
17. *Cobitis biwae* JORDAN et SNYDER.
18. *Anguilla japonica* T. et SCH.
19. *Hemirhamphus sajori* T. et SCH.
20. *Mugil cephalus* (LINN.).
21. *Therapon jarbua* (FORSKAL).
22. *Cottus kazika* JORDAN et STARKS.
23. *Cottus pollux* GÜNTER.
24. *Eleotris pisonis oxcephala* T. et SCH.
25. *Leucogobius guttatus guttatus* GILL.
26. *Acanthogobius lactipes* (HILGENDORF).
27. *Acanthogobius flavimanus* (T. et SCH.).
28. *Chaenogobius annularis* (GILL).
29. *Chaenogobius annularis urotaenia* (HILGENDORF).
30. *Tridentiger obscurus obscurus* (T. et SCH.).
31. *Tridentiger trigonocephalus* (GILL).

MIGITA, MASAO; MATSUMOTO, JUICHIRO; KINOSHITA, HIROSHI; SASAKI, AKIRA, and ASHIKAWA, ICHIRO 1951: Studies on the Hypophyseal Hormone of Fishes 1. Stimulating Effect upon the Ovulation of Trout. Bull. Jap. Soc. Fish., 17 (8,9), pp. 25–32. (in Japanese).

In Japan we use the hypophysical substances of carp and bull-frog for the early ovluation. The authors also make some experiments with the hatching rainbow-trout few weeks before their normal breeding season. Males treated with the hypophyses fell in maturation as early as one or a few days after the injection. On the other hand, females similarly treated, compared with those administered with the saline, showed no difference in the distribution of the dates when each ovulation was observed. Upon the touching perception from outside of the abdomen, however, the former showed some thought slight maturation within a week after the injection, but the latter hardly.

MINAMORI, SUMIO, 1951: Hybridization and Classification in Spinous Loaches. J. J. I., 1 (4), pp. 215–225, (in Japanese with English summary).

He has studied the twelve local races of spinous loaches from Western Japan from the morphological and ecological points. He made more than 17 groups of hybrids among eleven local races

collected from eight rivers and one lake in Western Japan. The local races established by IKEDA* in 1936, 1937, were quite sterile interspecifically by his experiments. A similar sterility also occurred among some inter-subspecific hybrids. From these experiments he has a different opinion on the classification of Japanese spinous loaches with that of IKEDA.

MINAMORI, SUMIO, 1951: Physiological Isolation in Cobitidae I. Two Races of the Striated Spinous Loach with Special References to the Difference in the Embryonic Respiration. Journ. Sci. Hiroshima Univ., ser. B, Div. 1, Zoology, 14 (1-19), pp. 199-212.

The author treated this problem and concluded. Two races of *Cobitis taenia striata* are distributed in the Honshû, bordering the Seto Inland Sea. The middle race is distributed in wide district, while the small race is limited in narrow region. Their distributing areas are overlapped, and a habitat segregation occurs between the two races. The small race respire more vigorously than those of the middle race do, even under the same conditions. These respiratory mechanism in both races may adapt itself to the environments. The metabolic systems of the two races seem to differ each other, since the Q_2-Consumption of F_1 hybrids derived from one of the reciprocal crosses was larger than that of the controls at the later embryonal stages.

NAKAMURA, MORIZUMI, 1951: The life History of a Cyprinid Fish, *Opsariichthys uncirostris* (T. et SCH.) in Lake Biwa. Misc. Rep. Res. Inst. Natur. Resources**, no. 19-21, pp. 70-78. (in Japanese).

The author observed the life history of *Opsariichthys uncirostris* (T. et SCH.) Which is a famous edible minnows in Lake Biwa. It occurs in Lake Biwa, (Shiga Prefecture) Lake Mikata, (Fukui Prefecture), Yamato River, (Nara Prefecture) and their tributaries. In Lake Biwa the present species found almost all over the water, but mostly found in rather clear and open part of the lake. This is so typically piscivorous that the adult feeds mainly on such fishes as "Ko Ayu", and on some minnows and gobies, together with few small aquatic insects. But the young feeds on Zooplanktons and insects. In the breeding season, the males have the pearl organs on the head, caudal peduncles and anal fins and exhibit the nuptial color. The spawning season extends from May to August. The number of eggs ranges from about 4,000 to 15,000. Newly hatched larva, 5.7 mm. total length has no pigments on the body and shows negative phototaxis. When the juvenile attained 29 mm. body length, it has hooked upper jaw and scaled. At least 2 or 3 years are need to grown for the maturation.

OGI, KENICHI, 1951: The Effect of Lithium on the Embryonic Development of a Fish, *Plecoglossus altivelis* (T. et Sch.). Scie. Rep. Tôhoku Univ., 19 (1), pp. 91-94.

The writer studies the lithium effect on the developing eggs of *Plecoglossus altivelis* and obtains many kinds of *microcephala* especially by treating the eggs at the gastrula stage. When the eggs of *Plecoglossus* were treated with dilute solutions of LiCL, five types of mostrosities including the *Cyclopia* were obtained as the results. The structures of monstrosities show that the ectoderm, the mesoderm, the mesoderm and the endoderm are affected by lithium, and that the susceptibility is different according to the germ layers.

OKADA, YAICHIRÔ, 1951: Some Problems on the Study of Freshwater Fishes in Japan. Misc. Rep. Res. Inst. Natur. Resources, No. 19-21, pp. 7-8. (in Japanese).

The writer pointed out the research problems of freshwater fishes in Japan from the standpoints of systematic, ecological and hereditical studies.

SATÔ, SHINICHI, 1951: A Note on the Fresh Water Cottoid Fishes in southern Hokkaidô. Bull. Fac. Fish. Hokkaidô Univ., vol. 1, no. 3,4, pp. 129-133.

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* IKEDA, H. 1936; Zool. Mag., XLVIII, pp. 983-994. IKEDA, H. 1937; ditto, XILX, pp. 4-8.

** Misc. Rep. Res. Inst. Natur. Resources = Miscellaneous Reports of the Research Institute for Natural Resources published by the Research Institute for Natural Resources, Tôkyô.

In Hokkaidô, *Cottus nozawae* is commonly found instead of *C. hangiongensis*. The author describes the ecological facts of the latter species. Since the year of 1947 he collected 31 specimens which were found in the lower courses of Daitobetsu, Mobeji and Hekirichi Rivers.

SUZUKI, RYÔ, 1951: Notes on the Development of unfertilized Eggs of *Misgurnus anguillicaudatus*. Collecting & Breeding. 13 (11), pp. 339-340. (in Japanese).

The writer made some experiments for the development of unfertilized eggs of loaches which were obtained at paddy field around Nodamura, Atsumi-gun, Aichi Prefecture on July, 1951. He put the eggs in a pure freshwater and could observe the morula stage by the egg segmentation.

TAMURA, TAMOTSU, 1951: On the Senses of Food-Searching in *Lateolabrax japonicus* (T. et SCH.). Bull. Jap. Soc. Scie. Fish., 17 (10), pp. 296-300. (in Japanese).

The author makes some experiments in the food-searching senses of young *Lateolabrax japonicus* (measured 4-4.6 cm. in body length) feeding on *Aplocheilus latipes*. Visual sense, especially moving objects, is important for *Lateolabrax japonicus* in his food-searching, but his sense for water vibration is indispensable and more significant than the former sense in case of going to snap this food; while his senses for chemical substances are not so essential in any process of his food-seeking.

TSUKAHARA, HIROSHI, 1951: List of Fishes of the Chikugo and Yabe River. Sci. Bull. Fac. Agri. Kyûshû Univ,* 13, pp. 1-4. (in Japanese).

The author collected freshwater Fishes in 1944 in the River Chikugo and Yabe of Kyûshû. He makes a following list.

Lampetra planeri
Coilia mystus
C. ectens
Oncorhynchus rhodurus
Plecoglossus altivelis
Aplocheilus latipes
Parasilurus asotus
Pseudobagrus aurantiacus
Liobagrus reini
Carassius carassius
Gnathopogon gracilis
Pseudogobio esocinus
Sarcocheilichthys variegatus.
Abbottina rivularis.
Pungtungia herzi.
Biwia zezera.
Pseudorasbora parva.
Hemigrammocypris rasborella.
Tribolodon hakuensis.
Moroco steindachneri.
Zacco platypus.
Z. temmincki.
Cobitis taenia.
Misgurnus anguillicaudatus.
Cyprinus carpio.
Rhodeus ocellatus.
Acheilognathus atremius.
Ach. rhombea.
Ach. tabira.
Ach. lanceolata.
Ach. limbata.
Hemibarbus barbus.
Anguilla japonica.
Hemirhamphus kurumeus.
Mugil cephalus.
Liza haematocheila.
Ophicephalus argus.
Lateolabrax japonicus.
Coreoperca kawamebari.
Trachidermus fasciatus.
Cottus kazika.
C. pollux.
Eleotris pisonis oxycephalus.
Mogurnda obscura.
Gobius giurinus.
G. similis.
Acanthogobius hasta.
Chaenogobius annularis urotaenia
Tridentiger obscurus.

YAMAMOTO, KIICHIRÔ, 1951: Activation of the Egg of the Dog Salmon by Water and the Associated Phenomena. Jour. Fac. Scie. Hokkaidô Univer., ser. VI, 10 (3-4), pp. 303-318. (in Japanese).

The writer makes an experiment to analyse the changes of the eggs of the Dog Salmon when put in water, the result of which is reported in this paper as follows. When the unfertilized eggs are activated in freshwater, the breakdown of the cortical alveoli, elevation of the chorion, and extrusion of

* Sci. Bull. Fac. Agr. Kyûshû Univ.=Science Bulletin of Faculty of Agriculture, Kyûshû University published by the Faculty of Agriculture, Kyûshû University, Fukuoka, Kyûshû.

the second polocyte occur in succession. The formation of the "Scheidewand" takes place along with the enlargement of the blastodisc. The eggs shed in water lose fertilizability in 15–30 minutes. This is attri butable to the membrane elevation accompanying the closure of the micropyle. In isotonic salt solution the eggs can not be fertilized even though inseminated. By experiments it is surmised that even if the "fertilization wave is provoked in the area of entry of a spermatozoon, it fails to propagate all over the egg in the isotonic salt solutions. Ionic concentration of the medium plays an important role in the conduction of the "fertilization-wave". The critical value is approximately M/10 in the case of b.s.s.

YAMAMOTO, TOKI-O, 1951: Action of lipoid Solvents on the Unfertilized Eggs of the "Medaka" (*Oryzias latipes*).

In 1939, 1945, 1949, the author discovered that the most prominent feature of fertilization in the egg of the "*Medaka*" is a wave like breakdown of the cortical alveoli, which begins near the animal pole and ends at the vegetal pole. This change is subsequently followed by the separation of the egg membrane which also begins at the animal pole and ends at the vegetal pole. The similar cortical changes are prooved by a number of kinds of artificial stimulation: mechanical, thermal, electric and chemical stimulations. In the present report, the author described many chemical experiments and concluded as follows. The ripe unfertilized eggs of the "*Medaka*" are activated with such lipoid solvents as chloroform, ether, benzene, toluene and iso-annyl alcohol. They are not activated with aceotne. Short exposure to the lipoid solvents induces nearly complete activation while long exposure results in only partial activation. The lipoid solvents evoke stimulation of the cortical protoplasm by dissolving the lipoid phase of the protoplasm. In short exposures to these agents stimulation is established and the "fertilization-wave" is not yet inhibited. With long exposure, the inhibitory effect of these agents on the "fertilization-wave" becomes apparent.

1952

AKITA, IKKAN and HORIGUCHI, HIROSADA, 1952: Notes on *Ischikauia steenackeri* (SAUVAGE) in Kagami Pond, near the Great Image of Buddha in Nara. Collecting & Breeding, 14 (12), p. 361. (in Japanese).

The writer found the present species in a small pond of Nara park which was established about 1200 years ago. This locality has not yet mentioned by any preceding authors.

HIKITA, TOYOJI, 1952: Notes on the Fishes and Aquatic Animals found in Lake Notoro in Hokkaidô. Sci. Rep. Hokkaidô Fish. Hatch., 7 (1, 2), pp. 1–18. (in Japanese).

The author collected 83 species of marine, brackish and freshwater fishes in Lake Notoro in Hokkaidô, during 1950 to 1952. Of these fishes, the writer points out the following freshwater fishes.

Hyporhamphus sajori.
Hypomesus olidus.
Hypomesus japonicus.
Pungitius pungitius.
Oncorhynchus keta.
O. masou.
O. gorbuscha.
Salvelinus leucomaenis.
Hucho perryi.
Entosphenus japonicus.

HIYAMA, YOSHIO, 1952: Thermotaxis of Eel Fry in Stage of Ascending River Mouth. J. J. I., 2 (1), pp. 23–30. (in Japanese).

The writer has studied the problem on how fish can notice the way of migration in open sea, or the presence of river mouth to ascend. He carried out the experiments on the thermotaxis of fish, undertaking to know thermotaxis of eel fry in stage of ascending river mouth from sea. Japanese common eel, *Anguilla japonica* of the size from 75 mm. to 90 mm. in total length caught at river mouth of Ikawazu, Aichi Prefecture during night of 1st of March, 1942 was used for the experiments.

HONMA, YOSHIHARU, 1952: A List of the Fishes collected in the Province of Echigo, including Sado Island. J. J. I., 2 (3), pp. 133-415. (in Japanese).

The writer listed the freshwater and marine fishes found in the Province of Echigo (Niigata Prefecture), including Sado, and Awashima Islands. Here only the freshwater fishes are extracted from his list.

1. *Eptatretus burgeri* (GIRARD).
2. *Lampetra planeri* (BLOCH).
3. *Lampetra japonica* (MARTENS).
4. *Oncorhynchus masou* (BREVOORT).
5. *Oncorhynchus keta* (WALBAUM).
6. *Salvelinus leucomaenis* (PALLAS).
7. *Salvelinus pluvius* (HILGENDORF).
8. *Salvelinus fontinalis* (MITCHILL).
9. *Plecoglossus altivelis* (T. et SCH.).
10. *Hypomesus olidus* (PALLAS).
11. *Salangichthys microdon* (BLEEKER).
12. *Parasilurus asotus* (LINN.).
13. *Pseudobagrus aurantiacus* (T. et SCH.).
14. *Liobagrus reini* (HILGENDORF).
15. *Phoxinus steindachneri* (SAUVAGE).
16. *Tribolodon hakuensis* (GÜNTHER).
17. *Zacco platypus* (T. et SCH.).
18. *Zacco temmincki* (T. et SCH.).
19. *Pseudogobio esochinus* (T. et SCH.).
20. *Cyprinus carpio* (LINN.).
21. *Carassius auratus* (LINN.).
22. *Hemibarbus barbus* (T. et SCH.).
23. *Gnathopagon elongatus elongatus* (T. et SCH.).
24. *Pseudorasbora parva* (T. et SCH.).
25. *Pseudoperilampus typus* (BLEEKER).
26. *Acheilognathus moriokae* (JORDAN et THOMPSON).
27. *Acheilognathus lanceolata* (T. et SCH.).
28. *Misgurnus anguillicaudatus* (CANTOR).
29. *Lefua echigonia* (JORDAN et RICHARDSON).
30. *Cobitis biwae* (JORDAN et SNYDER).
31. *Anguilla japonica* (T. et SCH.).
32. *Aplocheilus latipes* (T. et SCH.).
33. *Gasterosteus aculeatus aculeatus* (LINN.).
34. *Pungitius pungitius* (LINN.).
35. *Pungitius sinensis* (GUICHENOT).
36. *Hemirhamphus sajori* (T. et SCH.).
37. *Mugil cephalus* (LINN.).
38. *Lateolabrax japonicus* (CUVIER).
39. *Therapon oxyrhynchus* (T. et SCH.).

HORII, MASAO, 1952: Morphology of the Scales of Indigenous "Ayu" (*Plecoglossus altivelis*) grown in Various Environments. J. J. I., 2 (2), pp. 60-68. (in Japanese).

The author published previously the paper on the morphological variations by the adaption of "Ayu" to different environments especially food habits. Here he described the configurations of scale variations arranged on latero-central and latero-caudal parts of "Ayu" grown in various environments. The materials used in his observations were all at the same maturity and they were of three groups. The first group, composed of small "Ayu", obtained at Lake Biwa (weighed about 3 gr.). The second group is of somewhat larger "Ayu" ascending in River Ado from sea (weighted about 4 gr.). The third group of transplanted "Ayu" from Lake Biwa into River Masuda, Gifu Prefecture (weighted about 100 gr.). From the observation of these groups, he can found the morphological differences in the scales and consider them due to the differences in the rate of growth, and environmental factors.

HOTTA, HIDEYUKI, 1952: On the Time Change of the Number of the Anadromous "Ayu" (*Plecoglossus altivelis*) Ascending River from the Sea. J. J. I., vol. 2, no. 3, pp. 113-116. (in Japanese).

The author studied the relations between the number of ascending "Ayu" and the water temperature and time in the rivers. He has examined timely the number of young "Ayu" ascending Agano River, Niigata Prefecture and Naka River, Tokushima Prefecture from sea. The ascending season begins from April to early June. The water temperature ranged from 13°C to 16°C in that time. The maximum number of ascending young "Ayu" is counted at 9-10 a.m. or 1-3 p.m. In this season, the ascending number of "Ayu" usually increased in a few days before foul weather. The ascending number is gradually decreasing from June.

INNES, WILLIAM, T., 1952: Aquarium Highlights consisting of Reprints of the Most Popular Articles from the monthly Magazine "The Aquarium" since 1932.

This book is a gathering of the excellent records published in "the Aquarium" by INNES WILL. He took interesting topics of the gold-fish, titled "Gol-dfish, their Breeding end Care". The same author also took the interesting topics, "Where our Gold-fish come from" and STONYNER, A. J. also wrote on "Gold-fish at the Chinese New Year.

KANOH, YASUHIKO, 1952: On the Modifications of Cortical Alveoli and Development of Fish Eggs. J. J. I., 2 (3), pp. 99–103. (in Japanese).

The writer observed the changes of cortical alveoli of eggs of *Clupea pallasii*, *Oncorhynchus keta* and *Triboldon hakuensis* and discussed the relation between their egg development.

KANOH, YASUHIKO, 1952: The Morphological Studies on the Eggs of *Plecoglossus altivelis* (T. et SCH.). J. J. I., 2 (4, 5), pp. 147–152. (in Japanese).

The writer has observed the detailed construction of egg of *Plecoglossus altivelis* (T. et SCH.). He has also explained the adhesive mechanism of egg membrane to substratum.

KAWADA, SABURÔ and YOSHIMURA, CHÔSEI, 1952: Freshwater Fish, *Hypomesus olidus* and *Zacco platypus* are attracted by Artificial Light. Bull. Jap. Soc. Sci. Fish., 18 (5), 227–280. (in Japanese).

The authors carried out this experiment at Lake Sagami, Kanagawa Prefecture on February, 1952. It was revealed that two species *Hypomesus olidus* and *Zacco platypus* are attracted by either glow-lamp (200 W and 40 W) or fluorescent lamp (blue, blue white, pink, day-light and green). The behavior of the two fish toward light or positive phototaxis was detected by such fishing gears as lift net, gill-net and angling as fish-finder (50 Kc.). The detection being made as to the time and intensity against each lightening.

KAWAMOTO, NOBUYUKI, 1952. Ecological and Physiological Aspects of Crucian Carp in Winter. Tsuribito,* 7 (12), pp. 8–10. (in Japanese).

The author mentioned the habits of crucian carp in winter. He suggested a good angling station for anglers by understanding the ecological phenomena of the crucian carp.

KOBAYASHI, HISAO, 1952: Comparative Studies of the Scales in Japanese Freshwater Fishes, with Special Reference to Phylogeny and Evolution. J. J. I., 2 (4,5), pp. 183–191. (in Japanese).

The scale of fishes is of great significance in their classification. The author realized what a convenient material the scale character is to consider the affinity between the fishes. Even in the same individual, scales are very different in form and structure, according to the portion of the body which they are attached to. And finally he shows a large table of Japanese and exotic freshwater fishes by the scale constituents concerned to phylogeny of fishes.

MAEJIMA, MASANAO, 1952: Observations on the Hatching of *Cyprinus carpio* (L.) Egg. Collecting & Breeding, 14 (3), pp. 89–91. (in Japanese).

The writer described the normal development of the egg and larva of *Cyprinus carpio*. The materials were collected at Nozawa, Minami Saku-gun, Nagano Prefecture on May of 1948.

MATSUI, YOSHIICHI, OJIMA YOSHIO and NOZUSA SHUNSAKU, 1952: Chromosomes of *Ctenophayngodon idellus* (CUVIER et VALENCIENNES). Zool. Mag., 61 (10), pp. 288–289. (in Japanese).

The author investigated the chromosomes of *Ctenophayngodon idellus*. The diploid number of chromosomes was determined as 48 under the observation of the spermatogonial division. Since all the composed elements assume a simple rod shape showing slight variation in length, they are undoub-

*Tsuribito="Angler" Monthly Magazine published by Tsuribitosha Co. Ltd., Tôkyô.

tedly of telomitic nature in fibre attachment. The haploid number of 24 was observed in the primary spermatocyte metaphase. The external feature of chromosomes of this species is highly differentiated from that of the carp, but rather resembles with that of the crucian carp.

MINAMORI, SUMIO, 1952: Physiological Isolation in Cobitidae 1. Two Races of the Striated Spinous Loach with Special Reference to the Difference in their Embryonic Respiration. Jour. Sci. Hiroshima Univ., Ser. B, 13 (20), pp. 1-14.

Two races of *Cobitis taenia striata* are distributed in the Honshû, bordering on the Seto Inland Sea. The intermediate race is distributed in wide area, while the smaller race is limited in the distribution in narrower region. The distribution is overlapping with the two races. The writer considers that the smaller race may be adapted themselves to warmer waters rather than the intermediate race. The writer also makes an experiment of respiration of the smaller race and finds out that this race respires more vigorously than the intermediate race, even under the same conditions. The respiratory mechanism in both races may adapt itself to the environments. The metabolic systems of the two races seem to differ from each other, since the O_2-consumption of F_1 hybrids driven from one of the reciprocal crosses was larger than that of the controls at the latter embryonal stages.

MIYOSHI, SUSUMU, 1952: Response of Iridocytes in Isolated Scales of the "Medaka" (*Oryzias latipes*) to Chlorides. Ann. Zool. Jap., 25 (1-2), pp. 21-23.

The author deals with the response of iridocytes in the isolated scale of *Oryzias latipes* to various chloride solutions. Generally, the two types of chromatophores of this fish, melanophores and iridocytes, behave antagomistically according to the backgrounds. Against a white background, iridocytes expand and against a black background melanophores expand. His experiments on the changes of body colour were carried out and concluded as follows. When isolated scales are immersed in various chloride solutions, iridocytes and melanophores respond antagonistically. In NaCl solution, iridocytes contract; and in KCl, $CaCl_2$, $MgCl_2$, NH_4Cl, LiCl, $MnCl_2$, $BaCl_2$, $NiCl_2$, and $CdCl_2$ solutions, they expand. The alkaline chlorides KCl, NH_4Cl, LiCl, $CaCl_2$ and $MgCl_2$ vary in the rapidity of the expansion of iridocytes in the order: $K > NH_4 > Ca, Mg > Li$. The grade between $CaCl_2$ and $MgCl_2$ is uncertain.

NAKAMURA, MORIZUMI, 1952: The Japanese Dace. Tsuribito, 7 (10), pp. 8-12. (in Japanese).

The writer mentiond all about the Japanese dace. In his descriptions, the Japanese dace has a strong resistance for acidity. In Lake Osore, Aomori Prefecture, the pH is 3.0-3.4 and many daces are found in the lake except other fishes. Their foods are consisting of small animals and weeds; small fishes, fish eggs, spiders, land and aquatic insects larva and eggs, shrimps, worms, molluscs and weeds. The breeding season extends from March to June. Eggs are 2.5-2.8 mm. diameter, demarsal, with yellow or orange yolk sac. The incubation period is about 3 days under 20° water temperature. He also described many hatching methods which are carried out in River Chikuma, River Naka and other tributaries.

NAKAMURA, KAZUO, 1952: Environment, Food Habit, Spawning, Development, Growth and Fisheries of *Zacco platypus* in the River Chikuma. Bull. Fresh. Fish. Lab.,* 1 (1), pp. 1-25. (in Japanese with English summary).

This fish was introduced from Lake Biwa into the River Chikuma, Nagano Prefecture in 1929. The authors studied the general life history of the species during the years of 1947-1951. During summer, they are widely scattered in the waters of 30 to 50 cm deep. At night, however, the general habitat shifts to the shallower, standing waters of 5 to 10 cm deep. Youngs are seen everywhere in the river along either side of it's course. Adults in the River Chikuma depend on both animal and vegetable food, the former prevailing slightly over the latter in amount. Spawning of the species

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*Bull. Fresh Fish. Lab. = Bulletin of the Freshwater Fisheries Laboratory published by the Freshwater Fisheries Laboratory attached to the Bureau of Fisheries of Ministry of Agriculture and Forestry, Tôkyô.

takes place from early June to the later part of August, when the temperature records 15 to 24°C, but it's peak activity occurs during the 20 days extending from later part of June onward, when the river water shows the temperature of 18 to 22°C. The spawning beds are located in the mild current of 5 to 10 cm deep, where the bottom is formed by fine gravels and coarse sand. The eggs are deposited at the moment. The courtship and deposit of eggs requires only 30 seconds. Eggs are spherical, 2 mm in diameter, transparent without globules. Sexual maturity of the female is attained in the second year and with the male in the third and fourth year. Number of eggs carried by female is expressed by the formula $N=27.37W^{1,341}$ where W is the weight of body in gr. At the temperature of water 25°C, the eggs hatch out in 43–56 hours or more. The primary growth of scales was observed in the fish measuring 2.6 to 3.3 cm in total length. The winter ring on the scales usually begins to grow in September up to May of the following year.

NAKAMURA, YOSHIO, 1952: Some Experiments on the Thoaling Reaction in *Oryzias latipes* (T. et SCH.). Bull. Jap. Soc. Sci. Fish., 18 (3), pp. 93–101. (in Japanese).

The author made the experiments in a dark room of the Fisheries Department, Faculty of Agriculture, Tôkyô University, from December, 1949 to February, 1950. During this experiment, the water temperature in an experimental apparatus was varied between 8°C and 13°C. *Oryzias* were used for experiments. Through these experiments using the special apparatus, the following results were obtained. 1). WEBER-TECHNER's Law can be induced from the correlation between the reacting rate and the number of stimulating individuals. 2). The reacting rate is controlled chiefly by the number of stimulating individuals, but in a range of the number it is dominated by the momentum of the stimulating individuals as well as by other factors, while it remains almost unchanged so far as it is beyond a certain limit, no matter how much the number of stimulating individuals may be increased.

OTSUKA, SATOJI, 1952: Accelaration of Ovulation in the Gold-fish by Injection of Anterior Pituitary Extracts of Domestic Fowls and Frogs. J. J. I., 2 (1), pp. 45–49. (in Japanese).

The author made the experiments on the acceleration of ovulation in the gold-fish by injection of anterior pituitary extracts of domestic fowls and frogs. The results are as follows. The ovulation of one year old gold-fishes is accelarated by injection of anterior pituitary extracts obtained from frogs as well as domestic fowls. The extracts were made of 40% ethanol or 2% NaCl aqueous solution by the precedure which was adopted by JENSEN et AL. ('39) and CHOW et Sl. ('42) for extracting FSH and ICSH fractions from mammalian pituitaries. The substances extracted with 40% ethanol was separated into two fractions by 0.5 and 0.8 saturated solutions of ammonium sulphate. Each fraction, however, accelarated the ovulation of gold-fishes. This seems to be attributable to the impurity of both fractions.

SHIRAISHI, YOSHIICHI, 1952: Study on Spawning Migration of Pond-Smelt, *Hypomesus olidus* by Marking in Lake Suwa. Bull. Fresh Fish. Res. Lab., 1 (1), pp. 26–40. (in Japanese).

The writer studied (1949–1952) the general life history of *Hypomesus olidus* in Lake Suwa, Nagano Prefecture. Here he reports the pre-spawning migration under the ice in the lake, and the ascending of the fish to the Rokuto River which enters the lake, the former investigation aided by tagging. The result of his experiment for the migration route with tagged fish. Of 1,012 tagged fish released on January 25 and, 1951, 282 fish or 27.9% were recaptured. From the results of the recapture of tagged fish as well as the quantitative analysis of anadromous character of Lake Suwa pond-smelt, the fish which reached the natural spawning ground escaping the weirs were roughly estimated to amount to only 14% of the total fish caught in and around the lake in the season. The fish ascend the stream shoal after shoal, and they are usually observed in the late afternoon toward early evening. A study on the catch of these spawners (January 10 to March 20, 1951) and the record of catch obtained in 1950 and 1951 reveal that the number of spawning fish is represented by a normal frequency curve, with the peak of catch in middle of February. As to the sex-ratio of numbers during

the season, the male fish prevail in earlier period, but, toward the peak the two sexes become nearly equal, later, female prevailing, the general tendency of which is observed in salmonoid fish.

SUZUKI, RYÔ, 1952: Studies on the Interfamiliar Crossing of Loach ♀ and Gold-fish ♂. Collecting & Beeding, 14 (3), pp. 92–93. (in Japanese).

The writer tried to make a hybrid of *Misgurnus anguillicaudatus* and *Carrasius auratus*. The eggs were fertilized normally while the larva were hatched out abnormally, lasting only 5 days after hatching out.

TAKAGI, KAZUNORI, 1952: A Critical Note on the Classification of *Chaenogobius urotaenia* and its Two Allies. J. J. I., 2 (1), pp. 14–22, (in Japanese).

In Japan, *Chaenogobius urotaenia* and its two allies *Chaenogobius castanea* and *Chaenogobius isaza* are so closely resemble to each other. The author made the minute scrutining of these species by dealing with a lot of specimens, collected at many localities of Japan. He has found that there is no trait to assert them simultaeneously from each other. The characteristics given below, however, are useful for their taxonomy: diverging angle of glossohyal, upper aspect of tongue, presence or absence of scale on nuchal region, and ratio of depth of caudal peduncle against total length. From these characters, he has distinguished three species as a distinct species.

TAMURA, TAMOTSU, 1952: On the Senses of Food Searching in *Lateolabrax japonica*. Bull. Jap. Soc. Sci. Fish., 17 (10), pp. 296–300. (in Japanese).

The writer makes an experiment on the food-searching senses of *Lateolabrax japonica*. This experiment is quite useful to angling, and what was proved to be the most important sense of this fish in this experiment. Visual sense, for moving objects, is important for food searching and his sense for water vibration is also indispensable, but more significant is the former sense in case of going to snap at his food; while his senses for chemical substances are not so important in any case of his food-seeking.

TSUDA, MATSUE, 1952: Mammals, Aves, Pisces, Molluscs in Nara Prefecture. Nara Ken Sogô Bunka Chôsa Hôkokusho,* pp. 273–276. (in Japanese).

The writer identified the specimens of freshwater fishes preserved in many schools during 1951.

Lampetra reissneri.
Aplocheilus latipes.
Parasilurus asotus.
Liobagrus reini.
Gnathopogon elongatus elongatus.
Moroco steindachneri.
Zacco temmincki.
Carassius carassius.
Cyprinus carpio.
Misgurnus anguillicaudatus.
Cobitis biwae.
Anguilla japonica.
Mogurnda obscura.
Gobius similis.

WATANABE, MASAO, 1952: On the Young Salmons (*Onchorynchus keta* WALBAUM) caught in the Bay of Tôkyô. Misc. Rep. Res. Inst. Natur. Resources, no. 26, pp. 76–80. (in Japanese).

The writer described the young salmons obtained at Matsudo, Urayasu, Kanazawa-Hakkei and Kominato of Tôkyô Bay. Judging from the relation between the geographical distribution of these localities and the direction of sea-current, it may be concluded that these young salmons hatched in the upper part of the River Tone, get into the Tôkyô Bay through the River Edo and go to northward around the Bôsô Peninsula.

YAMADA, JURÔ and SAITO, SABURÔ, 1952: On the Appearing Mechanism of the Scale Structure. 1. The early Development of the Scale in the Rainbow Trout. *Salmo irideus* GIBBONS. Jour.

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* Nara Ken Sôgô Bunka Chôsa Hokokusho = Report of the Investigation for the Civilization, Nara Prefecture published by the Nara Prefecture Government, Nara.

Fac. Agr. Hokkaidô Univ., Vol. 1, No. 3, pp. 354–360. (in Japanese with English summary).

The writers study the early development of the scale of Rainbow Trout. Their results are as follows. The early scale appears in the dorsal of the larva and then they develop in head and caudal. Cells in the cutis papilla are arranged into two layers and among them a thin scale appears. The thinner upper layer of the scale is homogenous in structure with small ridges of circuli, while the lower becomes increasingly thicker showing some striped stratification. Growth of the upper layer of the scale is brought about by the scleroblasts existing around the scale margin.

YAMAMOTO, KIICHIRÔ, 1952: Studies of Fertilization in the Dog-Salmon, *Oncorhynchus keta* 1. The Morphology of the Normal Fertilization. Journ. Facul. Sci. Hokkaidô Univ., Ser. 4, 11 (1). pp. 81–94. (in Japanese).

The author studies the physiology of fertilization phenomena in *O. keta*, especially from the histochemical point of view. He concludes from his result as follows. The second maturation division persists in the stage of metaphase and the egg gradually advances in further course of division after the entry in spermatozoon. Entrance cone appears. The projecting area of the ooplasm disappears after a while. A sperm aster is apparent at the base of the sperm-head. Along with these changes the sperm-head advances towards the deeper part of the egg accompanying the sperm-aster. About three hours after insemination, there is found the metamorphosed female pronucleus resident at its original position with the sperm-head which is completely converted into the vesicular male pronucleus. After metamorphosis, the female pronucleus commences its migration to approach the male pronucleus hichw at that time has already arrived at the meeting position. It takes place within 3.5 to 4 hours after insemination has occurred. The male pronucleus is characterized by showing more distinct chromatin elements and smaller than the female pronucleus. After the pronuclei come in contact, they do not actually fuse, but lie side by side in close contact with the nuclear membrane intact. Thus the maternal and paternal chromosome materials are separated into distinct groups during through the stage prior to the first division, and further the chromosomes remain again separated in two groups of the maternal and paternal origins at the time of cleavage.

YAMAMOTO, TOKI-O, 1952: Osmotic Pressure and Cleavage in the Egg of the Brook Lamprey, *Lampetra reissneri*. Ann. Zool. Jap., 25 (1–2), pp. 1–7. (in Japanese).

The author discussed the osmotic pressure and cleavage in the egg of the brook lamprey in his experiments. The cleavage of the fertilized eggs of the brook lamprey, is inhibited in M/7 RINGER's solution. The fertilized eggs show slight but significant shrinkage in M/7 RINGER's solution. These facts indicate that M/7 RINGER's solution is hypertonic to the fertilized eggs. The ripe unfertilized eggs show neither swelling nor shrinkage in M/7 RINGER's solution. They are osmotically equivalent to M/7 RINGER's solution. They retained the capacity for fertilization and activation for 24 hours in the solution. Hence M/7 RINGER's solution is a physiological medium for the unfertilized eggs. He concluded that the osmotic pressure of the eggs will be markedly decreased when they are fertilized in freshwater.

1953

EGAMI, NOBUO, 1953: Studies on the Variation of the Number of the Anal Fin-rays in *Oryzias latipes*. 1. Geographical Variation in wild Populations. J. J. I., 3 (1), pp. 33–35: 3 (2), p. 87. (in Japanese).

The writer made the observation on the regional variation of number of the anal fin-rays in *Oryzias latipes* and the geographical variation. He has examined 4638 individuals collected at 69 different localities in Japan. The average number of anal fin-rays is different in localities. The differences are often significant among the fish distributing in the waters situated at the isolated regions. The number of the rays does not show a decrease or an increase according to the differences of the circumstances. The geographical variation is caused not by the agents of environment, but chiefly by the differences of the gene-constitutions.

HAMADA, KEIKICHI, 1953: Ecological Studies of the Pond Smelt, *Hypomesus olidus* (PALLAS) - I. On the local Difference of the Scale Structure. Bull. Jap. Soc. Scie. Fish., 19 (2), pp. 75–78, figs. 1–6. (in Japanese).

The scale of smelt, *Hypomesus olidus* (PALLAS), shows no definite annual-ring in such a manner as the scale of salmon or herring. Two different zones, one of which grows in summer and the other in winter, are recognized on the scale of the fish in Lake Kasumigaura by F. MATSUZAKI (1916), while, according to H. KOBAYASHI (1936), the fish of Lake Shironuma shows the spawning mark which may probably be formed due to spawning. The present research aims to find the local differences of scale structures of smelts. The fishes of three localities of Hokkaidô, the anadromous type of the river Ishikari, the land-locked form Lake Junsai and the fishes of Lake Abashiri connecting with the sea, were taken up as the materials under three different ecological conditions. The marks on the scales of smelt from Lake Abashiri ought to be thought as the spawning mark, but those of the fishes of Lake Junsai are the interstitial mark between the winter and summer zones, and the material from the River Ishikari lacks these marks. There, the scales of smelts differ with their localities and bear the different characteristic structure.

HAMADA, KEIKICHI, 1953: Ecological Studies of the Pond Smelt, *Hypomesus olidus* (PALLAS) - II. On the Pond Smelt of the old and the present Water-ways of the River Ishikari. Bull. Jap. Soc. Sci. Fish., 19 (2), pp. 79–82. (in Japanese).

The smelt, *Hypomesus olidus* (PALLAS), migrates inherently into the sea and ascends for spawning to streams, but the land-locked form also occurs commonly in lakes and pond in Japan. The studies on the land-locked form of Honshû, Japan have been carried out by many previous authors while, nothing has been studied on the fish which ascends in freshwater from the sea. Of the fishes of the River Ishikari, the school of the present waterway which ascends from the sea differs from the fish of the old waterway in the morphological characters such as the body length, the scale structure and the number of vertebrae. Consequently, each school of both waterways is independent ecologically from each other. The fish of the present waterway migrates into the sea, while the school of the old waterway stays through the life in fresh water, in spite of the presence of passage to the sea.

HIRANO, YOSHIMI, 1953: Migrating Course of Salmonoid Fish in North-West Areas of North Pacific as presumed by Tag-Experiments during the Years of 1917-42. I. Dog-salmon (*Oncorhynchus keta*) and Humpback salmon (*O. gorbuscha*). Bull. Jap. Soc. Sci. Fish., 18 (10), pp. 544–557. (in Japanese).

During the years of 1917–42 about 59161 individuals of adult salmonoid fish, mainly dog salmon (*Oncorhynchus keta*), humpback salmon (*O. gorbuscha*) and red salmon (*O. nerka*) were tagged and released in north-west areas of the North Pacific by the Hokkaidô Fisheries Scientific Institution and several other agencies. Of these tagged fish about 3379 individuals were recovered. Basing on the results obtained the author figured presumable migrating course of this fish in these areas, dealing with the first two species.

HOTTA, HIDEYUKI, 1953: A Note on the Sea Life of the Young "Ayu" (*Plecoglossus altivelis*). J. J. I., 3 (1), pp. 15–20. (in Japanese).

The writer made the observation on the sea life of "Ayu" at Mikawa Bay, Aichi Prefecture during November and May of 1952. The ascending of young "Ayu" from Mikawa Bay to rivers show some relation of water temperature, 14°–16°C. is optimum condition. The movements begin by the larger size of fish.

KAMOI, YASUO, 1953: Comparative Anatomy of Ophthalami of Teleostean Fishes. Jour. Med. Kyôto Univ., pp. 1-43. (in Japanese).

The writer makes a comparative anatomy of Ophthalami of many marine and freshwater fishes. He divides the nucleus of the fish into 3 groups and 14 kinds.

I). Dorso-interlateral group.
1. Nucl. habenulae.
2. N. posthabenularis.
3. N. dorsolateralis.
4. N. dorsalis.
II). Dorso- outerlateral group.
1. Nucl. geniculatus.
2. Nucl. praetecalis.
3. Nucl. anterior.
4. Nucl. parageniculatus.
5. Nucl. cortialis.
III). Ventro-lateral group.
1. Nucl. pracrotundus.
2. Nucl. rotundus.
3. Nucl. posterior.
4. Nucl. suprarotundus.
5. Nucl. subrotundus.

For this experiment, the writer selects the following freshwater fishes. *Mugil cephalus*, *Lateolabrax japonicus*, *Cyprinus carpio*, *Carassius auratus*, *Sarcocheilichthys variegatus*, *Gnathopogon caerulescens*, *Misgurnus anguillicaudatus*, *Salmo irideus*, *Hypomesus olidus*, *Plecoglossus altivelis*, *Anguilla japonica*.

KANOH, YASUHIKO, and ITÔ, SHIZUO, 1953: The Effect of Outer Medium upon the Cortical Change, Bipolar Differentiation and Karyokinesis at the Time of Activation in the Egg of Japanese Dace (*Tribolodon hakuensis*). Bull. Jap. Soc. Sci. Fish., 18 (10), pp. 462-467. (in Japanese).

The authors made the experiments for the eggs of Japanese dace. The materials were supplied with the eggs contained in the adults, breeding in Chitose River, Ishikari Province, Hokkaidô during the middle of June and August of 1951. The results of experiments are as follows: 1). When the egg is inseminated and put into freshwater, the break down of cortical alveoli, elevation of egg membrane and bipolar differentiation occur is succession and then a raised blastodisc is formed. Meanwhile karyokinesis also proceeds. 2). The same phenomena also take place when the egg is immersed in freshwater without insemination. Namely, the egg is activated merely with freshwater. 3). The activation in such a way is caused on contact with non-electrolyte, RINGER's or colloid solution, but it is affected by the salt concentration in the RINGER's solution and the concentration of the colloid retard the activation of the egg. In this case, the breakdown of cortical alveoli and the bipolar differentiation occur independently reacting with different velocities. 4). Some discussions have been offered by the authors in comparison with the well-known case in salmon egg, and is is concluded that, in regard to the activation, the Japanese dace egg seems to be different from the salmon egg, but this difference seems to depend on the difference in the rate of reaction. Thus, it can be said that the Japanese dace egg and salmon egg belong to the same type.

KAWAMOTO, NOBUYUKI, 1953: Eyes of Fish. Tsuribito, 8 (11), pp. 8-9. (in Japanese).
The writer mentioned the optical functions for the various kinds of baits of freshwater fishes. He also critisized many experiments of previous observers for marine and freshwater fishes.

KOBAYASHI, HIDESHI, 1953: Effects of Estrone upon the Structure, Weight and Fat Content of the Liver in the Fish, *Misgurnus anguillicaudatus*. Ann. Zool. Jap., vol. 26, no. 4, pp. 213-216. (in Japanese).

The author made some experiments on the effects of estrone or the liver of the loach. Generally, the fat content of the liver is very low (1.3-4.9%), showing no sexual difference during the breeding season. The liver is heavier in the females than in the males. Implantation of estrone pellet in fish of both sexes causes an increase in weight, but not in the fat concentration of the liver. The liver

cells of the normal female are smaller than those of the normal male, but those of the female have larger nuclei with conspicuous nucleoli.

KOBAYASHI, HISAO, 1953: Notes on Two Abnormal Japanese Smelts or Sweet Fish. Collecting & Breeding, 15 (9), pp. 279–280. (in Japanese).

The writer found two abnormalities of *Plecoglossus altivelis* (T. et SCH.) at Toyokawa River, Aichi Prefecture. One shows a curved vertebrae and the other is a shortened vertebrae. In these specimens, he remarked that there are no changes on the vertebrate number as usual.

KOBAYASHI, HISAO, 1953: Comparative Studies of the Scales in Japanese freshwater Fish, with Special Reference to Phylogeny and Evolution. J. J. I., 2 (4–5), pp. 183–191; 2 (6), pp. 246–260. (in Japanese).

By his studies on the difference in scale character of freshwater fishes found in Japan, he corrected the errors of some systematists, committed in their classification of fishes. He considered many imagines for the affinity between fishes, and the relation of phylogeny or evolution. Although the writer believes that the scale character is the best material for studying the affinity between fishes, and that no other structure shows the phylogeny of fishes. There are actually a great number of variations in scale character. Even in the same individual, scales are very different in form and structure, according to the portion of the body which they are attached to. He has remarked the important characteristics of scale contours, grooves, ridges, focus, growth line, lateral line scales, regenerated scales and scale arrangement. From his observations on the many scales, he concluded that the affinities of fishes can be guessed from the extent of similarity in scale character. Furthermore, where any two fishes which are alike in reality not withstanding their apparent alliance. On the other hand, where they are closely resembled in scale character, although their configurations are not so alike, a close affinity may be assumed and the further careful examination of other characters should be required. The author mentioned further considerations on the phylogenetical relations between Japanese species and continental species of Asia. The Japanese true freshwater fishes have their origin in Asia, and after separation of the Japanese islands from the continent, they were isolated geographically. The genera *Tanakia*, *Biwia*, *Ischikauia* and *Hymenopysa* are regarded as a typical Japanese. But from the scale characters, all of them have their origin in the continental species. This tendency is rather strong in Japanese Cyprinidae and Cobitidae, perhaps two families had the same ancestor in the continental species in the near past.

KUBO, IZUO; NEMOTO, HARUHIKO, and WATANABE, KAICHIRÔ, 1953; An Age-Determination basing on Scale-Analysis of a common Cyprinid Fish, *Hemibarbus barbus* (T. et SCH.). Bull. Jap. Soc. Sci. Fish., 19 (4), pp. 303–304. (in Japanese).

The authors declared the biological study of this fish, catching 158 specimens by set-net in Kasumigaura in the years 1947, 51 and 52. Sizes of the specimens ranges from 1.6–45.0 cm. in body length. From each specimen, 5 scales, from 13th to 17th ones, of the row just above this lateral line of left side were removed, and the most suitable one among them is chosen for measurement. From the results of scale measurement we could recognize the following facts. The ring formation of this fish takes place during the spring time of April. The breeding season occurs from May to June. Since it may be said the annuli indicate the age of the species in complete year.

KUBO, TATSUO and KOBAYASHI, TETSUO; 1953: Some Populations of Dog Salmon (*Oncorhynchus keta* (WALBAUM) in the Ishikari River System, Hokkaidô, and the Numbers of their Vertebrae and Lateral-line Scales. Bull. Jap. Soc. Sci. Fish., 29 (4), pp. 297, 302. (in Japanese).

There are found some different groups of dog salmon in the Ishikari River system. The authors have tried to discuss this fact from the numbers of vertebrae and lateral line scales. In the mean number

of vertebrae and lateral line scales, the dog salmon of the main Ishikari river and a tributary, the Toyohira River fairly exceed those of another tributaries, the Chitose River. The mean number of vertebrae of natural fry found in the main Ishikari river is numbered more than that of the fry hatching out in Chitose and Otoe hatcheries. Without the effect of any factor, the dog salmon of the Ishikari River sysist of two different groups. From these facts, we revealed that one group consist of mature salmon mostly ascend the home river during their spawning migration and the other group is the mature common salmon ascend from sea in the same season.

KUBOTA, ZENZIRO, 1953: On the maturing Process of the Ovary of Loach, *Misgurnus anguillicaudatus* (CANTOR)- II. Co-operative Action of Tannic Acid for Hormone. Bull. Jap. Soc. Sci. Fish., 18 (11), pp. 623-628. (in Japanese).

The author made the experiments for the co-operative action of tannic acid with pituitary hormone of frog to promote the maturation of ovaries of loaches. He prepared the fourth kinds of injection solutions. I group is so called original solution, only the solution of pituitary bodies, II group is composed of original solution and 5% tannic acid solution of 1/20 volume of original solution. III group is composed of original solution and 5% tannic acid solution of 1/10 volume of original solution. IV group is also composed original solution and 5% tannic acid solution of 1/5 volume of original solution. In the maturation process of ovary, group III resulted faster than the other groups. The percentage of matured egg (E_1) to all other eggs was 5.4 times of group I at the same time of 13 hours after injection. The maturation process of group I at the time hours after injection was equal to that of group III at the time of 4 to 6 hours after injection. With regards to the ripening of eggs in ovary after injection, the larger the eggs were, the faster the maturation was. The mean value of egg diameter in the posterior part of ovary was larger than that of the anterior. The results of the stimulation of hormon-action to both parts of ovary are unequal. The eggs of loaches injected into their bodies with the tannic solution which was added to the solution of pituitary bodies. After the artificial ferilization, the influence for hatching did not occur in this experiment.

KUROTA, NAGAMICHI, 1953: Fishes of Lake Biwa, with their Distribution Records. J. J. I., 2 (6), pp. 271-284. (in Japanese).

In the present report, the author included an introductory note on Lake Biwa with some notes on the fishes, a brief history of fish investgation from 1806 to 1951 and a complete list of the fishes (60 species) found in Lake Biwa. He listed 45 species and subspecies found in the lake itself, in addition to 2 species found around the lake and 13 introduced species. The distribution records in Japan and the adjacent countries are mentioned. Finally he noted two endemic species: *Gnathopogon elongatus caerulescens* and *Chaenogobius annularis isaza* and 19 species confined to Japanese waters and most of the remaining species (about 30 species) commonly found in Asiatic continent.

KUSA, MAMORU, 1953: Significance of the Cortical Change in the Initiation of Development of the Salmon Egg (Physiological Analysis of Fertilization in the Egg of the Salmon, *Oncorhynchus keta II*). Ann. Zool. Jap., 26 (2), pp. 73-77.

The writer made some experiments on the salmon egg. He mentioned in the present report that when placed in pure solution of $CaCl_2$ or $MgCl_2$, both isotonic and hypertonic with the egg contents, the unfertilized eggs of the salmon, *Oncorynchus keta*, are found to initiate development without visible breakdown of the cortical alveoli. When eggs thus incited to develop are placed in freshwater, the cortical change took place, but after a prolonged exposure to the experimental solutions, it was irrevessibly inhibited. These facts may indicate that the cortical change of the eggs at the time of fertilization and parthenogenetic activation is not a necessary factor for the initiation of the developmental activity, but seems to be only an independent phenomenon associated with or accessary to it.

KUSA, MAMOMU, 1953: On some Properties of the Cortical Alveoli in the Egg of the Stickleback. Ann. Zool. Jap., 26 (3), pp. 138-144.

The writer studied on the properties of the cortical alveoli of the egg of the stickleback. He has

mentioned that the alveolar structure of the cortical cytoplasm of the unfertilized egg of the stickleback, *Pungitius pungitius* (L). breaks down and disappears at the time of fertilization and artificial activation. It is found that, in each alveolus during the progress of breakdown, an opening like structure is formed, through which the alveolus itself comes to be forced out. By using cytochemical tests, the presence of a polysaccharide substance is accertained within the alveoli. This substance is not glycogen, but most likely it constitutes part of a mucroprotein. Thus it is concluded that, at the time of egg activation, this polysaccharide substance is liberated from the ooplasm and exerts a colloid osmotic effect beneath the chorion takes place. The breakdown process of the cortical alveoli is apparently associated with the change of optical properties in each alveolis. Furthermore, it is found that the alveoli seem to build up a heavier constitution within the ooplasm, as proved by the centrifugation test. These findings may disclose that the cortical alveoli of the stickleback egg have much in common with the corticatl granules of the sea urchin egg, not only in morphological character but also in the mechanism underlying the breakdown process.

MINAMORI, SUMIO, 1953: Physiological Isolation in Cobitidae. II. Inviability of Hybrids between the Mud Loach and Some Local Races of Spinous Loaches. Journ. Sci. Hiroshima Univ., ser. B, Div.1, Zoology, 14 (1–19), pp. 125–149.

In his previous report, he mentioned there some isolating mechanisms as difference of habitats, hybrid sterility and hybrid breakdown, more different local races of spinous roaches. Hybrid inviability in inter racial crosses of *Rana pipiens* has been investigated by rather from evolutio-national point of view. He perceived an intimate relation between the geographical distance and the strength of hybrid inviability. The northern races are larger in the size of egg and more adaptive to lower temperature. A similar relation is observable in hydrids between female mud loaches and different local races of spinous loaches which are used as male parents. It has been described that there are differences in egg size among the loacal races of spinal roaches and, moreover, an intimate relation between the egg size and temperature of these fishes. In this second paper, observations on differences in size of various kinds of cell as well as body length among the mud loach and some local races of spinous loaches, and the results of crossing experiments between them are reported.

MIURA, GORÔ. YAMAGUCHI, MASAO. MATSUMOTO, SHUZÔ. KATAOKA, TACHIZO. NAKAMURA, YOSHIKAZU. 1953: The Studies on the Breeding Habits and the distribution of youngs of *Hypomesus olidus* and *Salangichthys microdon* in Hachirô Lake, Akita Prefecture. Akita-ken Suikenjô Shiken Jigyô Hokokusho,* pp. 71–82. (in Japanese).

They studied the life history of two species *Hypomesus olidus* and *Salangichthys microdon* in Hachiro Lake, Akita Prefecture in 1953. They mention the spawning, the number of eggs, and the distribution of youngs in regard to the two species.

NAKAMURA, MORIZUMI and MOCHIZUKI, YAEO, 1953: On the Differentiatioan of Freshwater and Brackishwater Forms of Japanese Cyprinid Fish referred to Genus *Tribolodon*. Misc. Rep. Research. Inst. Nat. Resour. no. 32, pp. 11–22. (in Japanese).

The writers study the freshwater and brackishwater forms of *Tribolodon* in Japan and find out many variations of these forms. In the breeding season they distinguish them by the secondary sexual characters and the location of melanophores in post larva as well as the existence of black longitudinal bands on both lateral sides of body. The difference between two subspecies is influenced not by environment but naturally by genetics. They proposes the species name *Tribolodon hakonensis hakonensis* for freshwater form and *T. h. taczanowskii* for marine form.

NISHIDA, HIDEO, 1953: Histological and Cytological Studies on the Hatch of Salmon, *Oncorhynchus keta*. 1. On the Hatching Island, Mucous Cell, and Softening of Egg Membrane. Sci. Rep. Ho-

*Akita-ken Suisan Shikenjô Shiken Jigyo Hôkokusho = Report of the Fisheries Experiment Station, Akita Prefecture, published by the Fisheries Experiment Station attached to Akita Prefectura Government, Akita.

kkaidô Fish Hatch., 8 (1-2). (in Japanese).

The writer describes the hatching gland of *Oncorhynchus keta* in this report. Before the hatching out, two types of unicellular glands are present in the epidermis of salmon embryo. Numerous hatching glands in the oral cavity and gill appear at the larva, at about 2 or 3 days before the hatching out and then disappear after the hatch.

NOMURA, MINORU, 1953: On the Taxonomic Characters in the Mouth Cavity of Salmonoid Fishes J. J. I., 2 (6), pp. 261-270. (in Japanese).

The author classified eight species of Japanese salmonoid fishes *Oncorhynchus nerka, O. rhodurus, O. gorbuscha, O, keta, Salmo irideus, S. trutta, Salverinus pluvius* and *S. fontinalis*. According to the characters of the teeth, teeth-bearing bones and teeth-band, folds covered the vomer and palatines on the roof of mouth. He remarked that vomer and hyoid bone are more basic characteristic on the determination of genera and species of this group. The number of teeth on the vomer and palatines and tongue was less adequate as taxonomical character, as the teeth disappear after the breeding season and the number of teeth is reduced with age showing wide individual variations.

OGAWA, YOSHINORI, 1953: Some ecological Observations of "Medaka", *Aplocheilus latipes*. Collecting and Breeding, 15 (10), pp. 306-308. (in Japanese).

The "Medaka" is mostly used for the laboratory of biological course of High School in Japan. It is a temperate fish and rather difficult to breed in cold regions of Japan. The author tried to make many experiments at Noto district of Ishikawa Prefecture and succeeded to breed in cold regions of Japan.

OGAWA, TSUNENOBU, 1953: Studies on the Urogenital Sinus of Gobioidae Fish. I. On a Gobioidae fish; *Odontobutis obscura* (T. et Sch.). Collecting & Breeding, 15 (6), pp. 180-181. (in Japanese).

The author described the urogenital sinus of *Odontobutis obscura*. He remarked that the character may be recognized as a specific difference for systematics.

SAITÔ, SABURÔ and YAMADA, JURÔ, 1953: On the Appearing Mechanism of the Scale Structure II. The Scale Structure of the Crucian Carp, *Carassius auratus* (L). examined with the Regeneration. Jour. Fac. Agric. Hokkaidô Univ. 1 (4). pp. 555-560. (in Japanese with English summary).

The writers studied the developmental mechanism and constitution of scales by the crucian carp. The Custis papilla differentiates from the scleroblast to make an anlage of the scale. This anlage will be situated on the upper layer of future scale, the scale pocket growing larger and the anlage extending. The scleroblast gradually disappear except the margin of the scale anlage. Then the hypodermal layer secretes the lower layer of the scale and shows the complete formation of the scale.

SATÔ, MITSUO, 1953: On the Sensory Papillae of a Japanese Goby, *Rhinogobius similis* (GILL). J. J. I., 3 (2), 2, pp. 53-55. (in Japanese).

The writer observed the sensory papillae on the skin of the head of *Rhinogobius similis* (GILL), These sensory papillae are easily detected as a whitish spot microscopically. The papilla in the medium size is about 0.2 mm. in diameter in its base, 0.05 mm. in diameter in its apex, and 0.08 mm. in its height. The papilla projects prominently above the surrounding epidermis and has a dome-shape in its section. The specific sensory cells with an elongated pear-shaped form, provided with cilia or sensory hairs, crowded closely in the outer portion of the papilla. The specific sensory cells are surrounded by extremely long cells which seem to be supporting cells. Each papilla is situated upon the corium which elevates upward the base of papilla and is penetrated by nerve fibres. He remarked that these papillae seem to be generally prominent in gobioid fishes in such fishes as those equipped with poor canal line system.

SATÔ, SHINICHI and KOBAYASHI, KIYU, 1953: Ecological Studies on the Freshwater Cottoid Fishes. I. Breeding Habits of *Cottus hangiongenesis* MORI. Bull. Facul. Fish. Hokkaidô Univ., vol.

3, no. 4, pp. 233-239.

They describe the breeding habits of *Cottus hangiongenesis* in the Hekirichi River of Hokkaidô. The spawning occurs from late April to mid May, at the water temperature ranging from 9.6°C to 18.6°C. This fish deposits egg masses under stones. The eggs are light yellow measuring 2 mm in diameter. The ovarian eggs in a mature female are counted 934.8 in the average of 9 individuals, ranging from 770 to 1462 in number.

SUZUKI, RYO, 1953: Studies on the interfamiliar Crossing between Loach (*Misgurnus anguillicaudatus*) and Gold-fish (*Carassius auratus*). J. J. I., 3 (1), pp. 5-14. (in Japanese).

The author made the reciprocal crossing between mud loach and gold-fish to explain the development and the effect of the genes. At the early stage of development, it was found that more dead eggs were among the interfamiliar hybrid ones than in the case of the normal crossing, and the number were much more increased at the gastrula stage. The larvae which were produced from mud loach ♀ × gold-fish ♂ survived for 14 days and produced from gold-fish ♀ × mud roach ♂ survived for 24 days, but many of these larvae had an obstacle of development in the head, the tail and the yolk sac. The nuclei of the normal larvae of mud loach were found to be very small compared with that of gold-fish. In the case of mud loach ♀ × gold-fish ♂, however, the nuclei were bigger than those of the normal larvae of gold-fish, while the nuclei of the larvae hatched out of mud loach ♀ × gold-fish ♂ were smaller than those of the normal larvae of gold-fish. The normal larvae of mud loach had no melanophores immediately after having been hatched, but the normal larvae of gold-fish had already melanophores ranging from 120 to 240 as soon as they were hatched. More melanophores, however, appeared in the case of gold-fish ♀ × mud loach ♂ they appear less in number as compared with the normal larvae of gold-fish. From these facts mentioned above, the author concludes that these abnormal results are effected by the paternal as well as maternal genes.

SUZUKI, YOSHINORI, 1953: Notes on the abnormal Barbels founds in a Japanese Bitterling and in a Mudloach. Collecting & Breeding, 15 (10), p. 296. (in Japanese).

The writer found two examples of misformed barbels of *Acheilognathus lanceolata* and *Misgurnus anguillicaudatus*. The former specimen collected at Sugase River (a branch of Yahagi River), Aichi Prefecture, has four barbels instead of 2 barbels in normal. The latter specimen collected at Sakurai village, Hekikai-gun, Aichi Prefecture, has a branched barbel.

TAKAGI, KAZUMORI, 1953: A Study on the Scale of the Gobioid Fishes of Japan. Jour. Tôkyô Univ. Fish.,* 39 (2), pp. 231-253. (in Japanese).

The writer studies comparatively the configuration of the scale of 21 specimens, two of which belong to freshwater fishes. On each species the writer makes every scale description and circuli.

UCHIDA, KEITARÔ, 1953: Eggs and Larva of *Liobagrus reini* HILGENDORF. Zool. Mag., 45 (536), pp. 289-292. (in Japanese).

The author obtained three egg masses under the stones, in the shallow current of the River Seikawa, Heiando, Korea. Each eggs are enveloped by gelationous substance, attaching together into a mass of 3-4 cm in diameter, including 100-120 eggs. Eggs are cubical, measuring 3.3 mm yolk heavy, 2.8 mm × 1.9 mm in size. Yolk is transparent, yellow, with minute granules, without oil globules. After 8 days of incubation, the embryo hatches out (temperature 17°-22°C). The embryo just hatched out is 1.8 mm in length, and 13+25=38 Myomeres.

YANAI, TAKAICHI, 1953: Hatching Glands of the Bony Fish, *Salangichthys microdon*. Zool. Mag., 62 (1), pp. 20-22. (in Japanese).

The author made the observation on the hatching glands of *Salangichthys microdon* larvae which were

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*Jour. Tôkyô Univ. Fish = Journal of Tôkyô University, Fisheres Laboratory, Tôkyô, published by the Fisheries Institute of Tôkyô University, Tôkyô.

obtained at Lake Shinji, Shimane Prefecture by the artificial fertilization on March of 1952. In the larvae shortly before hatching, 300 to 400 unicellular glands, filled with secretory granules, are present along the median dorsal line between the nasal pits and the posteriore nd of the snout. After discharging the secretory granules of the larvae before hatching, the glands degenerate in a few days. The glands are derived from the epidermal cells on the lateral sides of larva, and move to the dorsal side. The glands are analogous to the hatching glands of amphibians, derived from the neural crests.

YOSHIHARA, TOMOKICHI, 1953: On the breeding Experiments of Carp under different Conditions of Environment with an Appendix of the Monograph on the Condition Factor. Bull. Jap. Soc. Scie. Fish., 18 (7), pp. 283-286. (in Japanese).

The author made the breeding experiments on carps under different conditions on environment for 150 days from May 18th to October 15th of 1950 and from June 13th to November 9th of 1951. He divided nine groups of carp and reared in nine ponds for three years. Lately he made the observations on the growth rates. The results show that under high density of fish population the rate of growth is low.

1954

DÔTSU, YOSHIE, 1954: On the Life History of a Goby, *Chaenogobius castanea* O' SHANGHNESSY. J. J. I., 3 (3-5), pp. 133-138. (in Japanese).

The writer made the observation on the life history of a small goby *Chaenogobius castanea* which is common in estuaries and shores of Japan throughout. The present goby passes the whole period of its life. The spawning season extends from January to April in the vicinity of Fukuoka City, Kyûshû. The male is smaller than female and before breeding the male makes a room for breeding, usually utilizing the vacant living hole of *Urogebia maior* DE HAAN, a small shrimp-like crustacean. The eggs are deposited on the inner wall of the hole, measured about 1cm in diameter and 5-10 cm. deep. The female leaves the hole soon after spawning, while the male stays to guard the eggs until they hatch out. The egg is rather large and club-shaped, about 4.1 mm × 1.3 mm. in large. The newly hatched out larva is 7 mm. in total length. The larvae of 10-16 mm. in body length is passing a pelagic life in the bay, mainly feeding on copepods. The juvenile of 20 mm. in body length commerces a bottom-life, and feed on benthos.

EGAMI, NOBUO, 1954: Studies on the Variation of the Number of the Anal Fin-rays in *Oryzias latipes* II. Cross Experiments. J. J. I., vol. 3, no. 3-5, pp. 171-178. (in Japanese).

This is the second report of the variation of the number of the anal fin-rays by the writer. He made experiments on the crossing of *Oryzias latipes* to explain the inheritance of the number of rays in the anal fin. The effect of selection was observed in the first two selective generations. The inheritance of the character seems to follow the scheme of polygenes. The number of the rays is also subject to a drastic change by a major recessive gene "fused".

EGAMI, NOBUO, 1954: Notes on the Effect of Changes in the Light-Condition and Salinity of the Medium on the Appearance of Male Characters in Females of the Fish, *Oryzias latipes*, kept in Androgen-water. Ann. Zool. Jap., 27 (3)., pp. 118-121. (in Japanese).

The writer made some experiment on the females of *Oryzias latipes*. He mentioned in the present paper that of females of *Oryzias latipes* are kept in a dilute solution of the androgen, methyldihydrotestosterone, small papillary processes and guanophores appear on the anal fin of the fish. Both are male characters and are not found in normal females. Changes in the light condition and salinity of the culture medium do not affect the appearance of these characters.

KATAOKA, ATSUMU, 1954: Notes on Double-Monster of Carp. Collecting & Breeding, 16 (1), p. 13. (in Japanese).

The writer mentioned a double-monster of carp which was obtained from Kamonomiya Fish Culture Pond attached to the Fisheries Experimental Station of Kanagawa Prefecture.

KATAOKA, ATSUMU, 1954: Notes on the Brooding of cultivated "Ayu" (*Plecoglossus altivelis*). Collecting & Breeding 16 (12), pp. 363-364. (in Japanese).

The writer examined the number of the eggs contained in the cultivated "Ayu" keeping in a small pond connected with Odawara River, a branch of Ichikawa, Hyôgo Prefecture. The number varies from 45.965 minimum to 273.116 maximum from the specimens ranging from 16.4 cm. to 24.2 cm. body length.

KAWABATA, MASAKAZU, 1954: Sobio-ecological Studies on the Killifish, *Aplocheilus latipes*. 1. General Remarks on the social Behavior. Jap. J. Ecol.,* 4 (3), pp. 109-113. (in Japanese).

The writer observed the social behaviors of the killifish with special reference to the territoriality and social hierarchy. He established 6 aquaria each having a diameter of 18 cm. and 1, 2, 3, 5, 7, and 10 pairs of the fish were released respectively. Fighting occurs between the members of the groups in the aquaria almost throghout the year, even in the winter when the breeding season is over. The fighting behavior is represented in general by a sudden aggresion taking place. Fighting is observed in both males and females, or even in the sexually immature fishes. The patterns of social behavior differ with the difference of group densities. In the groups of 1 and 2 pairs no territory-holding individual is observed, while in each of the group of 5, 7 and 10 pairs one individual occupies a territory and the others struggle in the remaining space. In the group of 3 pairs such differentiation is obscure, though sometimes a territory-holding individualappears. The fluctuations of fighting freequencies from day to day also differ with the difference of densities, corresponding with the types of social differentiation. A territory is usually established at the bottom of the aquarium, but two or more territories are seen when the space is divided into small parts by weeds. When only one territory is formed, the occupant of the territory is seemingly the most dominant individual in the group and the remaining fishes which have no territory, are subordinate ones. Therefore, it may be said that the formation of the territory is not affected by the place factor, but also closely related to the dominance hierarely in the group.

KOBAYASHI, HIROMU, 1954: On the Variation of Body Color in Loach, *Misgurnus anguillicaudatus*. Collecting & Breeding, 16 (6), pp. 167-169. (in Japanese).

The writer described many cases of color variations of loach obtained at Asahigawa River, Sapporo City and Chitose district of Hokkaidô. He described many cases of a black race, colored race, Albino and intermediate form of black and albino.

KOBAYASHI, HISAO, 1954: Comparative Studies of the Scales in Japanese Freshwater Fishes, with Special Reference to Phylogeny and Evolution. J. J. I., 3 (2), pp. 83-86. (in Japanese).

In this paper, the writer mostly discusses the Suborder *Isopondyli* including the genus *Coilia*.

KOBAYASHI, HISAO, 1954: Comparative Studies of the Scales in Japanese Freshwater Fishes, with Special Reference to Phylogeny and Evolution. J. J. I., 3 (3-5), pp. 203-208. (in Japanese).

The author treated suborder Isospondyli (including freshwater fishes Dorosomatidae and Coregonidae) in this present paper. He described the scale constitutions of many species of two families.

KOBAYASHI, HISAO, 1954: Phylogenetical Consideration of Japanese Cobitid Fishes by Study of Scale Character (1). Bull. Aichi Gakugei Univ.,** 4, pp. 40-48. (in Japanese).

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* Jap. J. Ecol. = Japanese Journal of Ecology published by the Ecological Society of Japan, Sendai, Miyagi Prefecture.

** Bull. Aichi Gakugei Univ. = Bulletin of Aichi Gakugei University, Okazaki, Aichi Prefecture.

The writer treats the scales of Cobitidae consisting 7 species of 4 genera in Japan and discusses the phylogenetical point.

KOBAYASHI, HISAO and SUZUKI, RYO, 1954: Notes on the Variation found in Fishes (1). Collecting & Breeding, 16 (10), pp. 313–315. (in Japanese).

The writers mentioned an abnormal specimen of *Rhiobagrus reini* which was collected at Hatazumachi, Aichi Prefecture. It has seven barbels instead of eight in normal. He has also mentioned an abnormal scales of *Carassius auratus*.

KURATA, YOJI and IMURA, TOSHIO, 1954: Injurious Effects of *Tribolodon hakuensis hakuensis* (GÜNTHER) on Shell-Fish. Collecting & Breeding, 16 (8), pp. 233–234. (in Japanese).

The writer examined the foods of Japanese dace collected at Omoro, Tôkyô-fu on September, 1952 and found many kinds of shells. They mostly belong to *Brachidontes senhosia* (BENSON), *Meretrix lusoria* (RODING), *Venerupis semidecussata* (REEVE), *Mactra sulcataria* REEVE, *M. veneriformis* REEVE, *Sanguinolaria olivacaa* (TAY) and *Solengouldi conrad.*

KUBOTA, ZENZIRÔ and MATSUI, ISAO, 1954: Influence of Temperature on the Embryonic Development of the Loach, *Misgurnus anguillicaudatus* (CANTOR). Jour. Shimonoseki Coll. Fish.,* 3 (3), pp. 209-215. (in Japanese with English summary).

The writers make an experiment of the influence of temperature on the embryonic development of loach. They mention that the range of water temperature which is possible for hatching is from 12 to 31°C, and the suitable water temperature is from 20 to 28°C. The optimum temperature is about 25°C.

MATSUSHIMA, MATAJIRÔ and MATSUI, ISAO, 1954: A New Habitat of *Eleotris phsonis oxycepiala* T. et SCH. Collecting & Breeding, 16 (10), p. 295. (in Japanese).

The writer found this species in Edo River, Tôkyô City on June, 1952. This is new locality, and not yet found far north geographical distribution.

MINAMORI, SUMIO, 1954: Temperature Adaptation of Some Local Races of Striated Spinous Loach. Jap. Ecol. 4 (2), pp. 66-68. (in Japanese).

The writer remarked the differences in high temperature forelance and growth among five races of the striated spinous loach, *Cobitis taenia striata* are described. These fishes were reared at 20°, 25°, 30°, 33°, 34°, 35°, and 36°C during developmental stages. The five races differ from each other in high temperature forelance, as in the following order. Large race < Middle race < Biwa-small race < Spotted small race ≒ small race. The five races differ from each other in total length of young fishes, reared at the same temperature, as in the following order. Small race ≒ Spotted small race < Biwa small race < Middle race < Large race. The order is completely parallel with that in body length of adult fishes or in egg diameter, and reverse to that in high temperature torelance. In the same race, the total lengths of young fishes vary with differences in temperature. They become larger at lower temperature and smaller at high temperature. This phenomenon is considered as an expression of physiological responses of individuals to thermal conditions.

NAKAMURA, MORIZUMI, 1954: Hybrid of Fish. Tsuribito, 9 (7), p. 29. (in Japanese).

The writer described many examples of hybrids of Japanese freshwater fishes, which are made by previous authors in Japan. He also made a crossing experiment of two subspecies of *Carassius auratus* ("*Kintaro*" and "*Hera*") to solve an interesting race of this group.

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* Jour. Shimonoseki Coll. Fish. = Journal of the Shimonoseki College of Fisheries published by the Shimoseki College of Fisheries attached to the Ministry of Agriculture and Forestry, Tôkyô.

NISHIDA, HIDEO, 1954: Occurrence of a Remarkable Gland in the Oral Cavity Epidermis of Adult Salmon, *Oncorhynchus keta.* Scie. Rep. Hokkaidô Fish. Hatch., 9 (1. 2), pp. 147–150. (in Japanese).

He describes a peculiar gland in the oral cavity of Salmon, collected at the Ishikari sea-coast, in October of 1953. The glands are located in the epidermis of the ventral side at the base of branchial arch. The glands stained deeply with toluidin blue metachromatically.

NOMURA, MINORU, 1954: On the Taxonomic Characters in the Mouth Cavity of Salmonoid Fishes. II. Pacific Salmons. J. J. I., 3 (6), pp. 232–237. (in Japanese).

In the present paper, the author discussed 5 species of Pacific Salmons taxomonically. He remarked that the distinguished characters of the relative position and the arrangement of vomerine and palatine tooth bands on the roof of the mouth and the features of tooth bands, teeth and labial tooth bands ase rather important for their classification. The main differences among the species are shown here. *Oncorhnchus nerka* and *O. tschawytscha* exhibit a wide differences in the position and the form palatine tooth band from other species. *O. masou* and *O. keta* show wide differences in the position and the form of vomerine tooth band. In *O. gorbuscha,* the tip of its vomerine tooth band projects more beyond the palatine tooth band than other species, from one-third to one-fourth in length of vomerine tooth band.

OKADA, YAICHIRÔ, 1954: Fishes of Northern Europe. Tsuribito, 9 (8), p. 27. (in Japanese).

The writer mentioned the fishes of Northern Europe, when he made a trip to Europe in 1953. The characteristic of the European fish is very few in species but very much amount in quantity. In every fish market, we have to see herring, sardin, cod, flattfish and flounder. The fishing amounts of these fishes are not changed from the olden times up to the present by the help of scientific investigation.

SATÔ, MITSUO, 1954: On the Sensory Papillae of Japanese Goby, *Rhinogobius similis* (GILL). J. J. I., vol. 3, no. 2, pp. 53–55. (in Japanese).

The writer mentions a histological constitution of the sensory papillae of a common goby *Rinogobius similis.* He notes that the papillae seem to be generally prominent in those fishes as those equipped by a poor canal line system.

SATÔ, MITSUO, 1954: Studies on the Pit Organs of Fishes II. The Function of the Large Pit Organs, with Special Reference to the Inducibility of Intestinal Respiration in the Loach. Scie. Rep. Tôhoku Univ. Biol., vol. 20, no. 4, pp. 334–344.

The author reports the function of the large pit organ on the basis of the inducibility of intestinal respiration in the loach. He observes that when water vibrations and currents caused by the movement of one loach upward to the surface of water for intestinal respiration reach another, the latter also makes the respiratory movement, and thus the phenomenon of inducibility of respiratory movement takes place. This inducibility is not impaired by the deprivation of the visual, olfactory and auditory senses, but is obstructed by the separation of fishes. When the pit organs are anaesthetized with cocain, the induction of simultaneous movement is greatly impaired. From these results the large pit organ seems to be recognized as a receptor of water movement. The irregular water vibration or current aroused by the respiratory movement of one individual is received by the pit organs of the others, and thus the respiratory movement of the other fishes can be induced.

SHIMAZU, TADAHIDE, 1954: Stocking Results of Ayu-Fish (*Plecoglossus altivelis*) in the Nuru-River, Gumma Prefecture, 1950 to 1952. Bull. Fresh. Fish. Lab., 3 (2), pp. 1–25. (in Japanese).

The author reports the production of *Plecoglossus altivelis* in the Nuru-river, Gumma Prefecture during 1950 to 1952. This production has declined recently due especially to the construction of dams. All fishermen who desire to maintain or increase the production of this fish in the rivers have brought up the extensive practice of stocking of the fry into the river, throughout the country.

SHIRAISHI, YOSHIKAZU, 1954: Feeding Habits of the Pond-Smelt, *Hypomesus olidus* and the Plankton Succession in Lake Suwa. (Part 1). Symp. Mar. Freshwater Plank. Indo Pacific Madras., pp. 1-2. (in Japanese).

The writer studied the feeding habits of *H. olidus* in the year 1951 referring to the succession of plankton in Lake Suwa, Nagano Prefecture, in Japan. He wishes to fill a gap in the information on the food-chain in the water as well as to obtain the basic knowledge on which the management of the species could stand.

SUZUKI, RYO and YANADA, TSUKASA, 1954: Notes on the Development of the Eggs of Loaches after the Treatment with Sea-water. Collecting & Breeding, 16 (11), pp. 345-346. (in Japanese).

The authors made some experiments for the development of the eggs of loaches by treating with seawater. When he put the eggs into 30% seawater, they hatch and develop normally without deformed larva but in 40% seawater, they were died and their hatched larva were deformed. In 70% seawater solution, no eggs developed.

TAGUCHI, KISABURÔ and NISHIKAWA, KIYOSHI, 1954: Some Knowledges on the Migration of Salmon in Asiatic Region inferred from the Data of the Past. I. Red Salmon (*Oncorhynchus nerka*). Bull. Jap. Soc. Sci. Fish., 20 (7), pp. 581-585. (in Japanese).

The authors contribute many previous datas on the migration of Red Salmon (*Oncorhynchus nerka*). They describe the result in this report conclusively: most of Red Salmon which appeared off southern part of the eastern coast of Kamtchatka continue to migrate northwards until the end of June. But in early, the southwards migrants come to increase in number.

TAGUCHI, KISABURÔ and NISHIKAWA, KIYOSHI, 1954: Some Knowledges on the Migration of Salmon in Asiatic Region inferred from the Data of the Past. II. Chun Salmon (*Oncorhynchus keta*). Bull. Jap. Soc. Fish., 20 (7), pp. 586-590. (in Japanese).

The authors report the results of tagging experiments of Chun Salmon during 1935 to 1937 at the 21 fishing grounds in Russian Territory by the Nichiro Fisheries Company. Along the coast of the Kamchatka River, Nachigui and Kholylin Regions, Chun Salmon has a tendency to migrate northward. On the west coast of Kamtchatka, fishes migrate northwards and few of them southwards. The next experiments carried out in the southern east Kamtchatka for 5 years from 1936-1941, 2070 of the Chums liberated in the offing of the eastern coasts of South Kamtchatka, runs northwards and 5090 runs southwards.

TSUDA, M., and GOSE, K., 1954: Ecological Studies of aquatic Animals in the River Yoshino, Nara Prefecture Sôgô Bunkachôsa Hôkokusho. Yoshino Ryuiki. Dôbutsuhan, pp. 201-220. (in Japanese).

In this report, the authors inform the distribution of freshwater fishes in the River Yoshino, Nara Prefecture. They listed 36 species of freshwater fishes of this river and tried to divide the river into four districts from the distribution. The upper most district is called "Amago Iki" and has a characteristic of very cold water temperature from 10°-20°. In this district, *Oncorhynchus rhodurus* (dominant), *Moroco steindachneri*, *Zacco temmincki*, *Tribolodon hakuensis*, *Gobius similis*, *Liobagrus reini*, *Cottus japonicus* and *Cobitis biwae* are found. The second district called "Oikawa Iki", ranging of 18°-25° water temperature, has a characteristic of fish fauna of *Lampetra reisseri*, *Oncorhynchus rhodurus*, *Pseudogobio esocinus*, *Morocco steindachneri*, *Zacco temmincki*, *Zacco platypus* (dominant), *Tribolodon hakuensis*, *Pungtungia herzi*, *Cobitis biwae*, *Cobitis taenia striata*, *Cottus kazika*, *Cottus japonicus*. The third district called "Koi Iki", ranging of 23°-30° water temperature, has a characteristic fish fauna of *Lampetra reissneri*, *Parasilurus asotus*, *Pelteobagrus nudiceps*, *Liobagrus reini*, *Acheilognathus cyanostigma*, *Acheilognathus limbata*, *Acheilognathus lanceolata*, *Hemibarbus barbus*, *Hemibarbus longirostris*, *Gnathopogon elongatus caerulescens*, *Gnathopogon elongatus elongatus*, *Pseudorasbora parva*, *Pseudogobio esocinus*, *Pungtungia herzi*, *Tribolodon hakuensis*, *Zacco platypus*, *Carassius auratus*, *Cyprinus carpio* (dominant), *Misgurnus anguilicaudatus*, *Cobitis biwae*, *Co-*

bitis taenia striata, *Cottus kazika*, *Odontobutis obscura*, *Gobius similis*, *Tridentiger obscura*, and *Sicydium japonica*. The fourth district is a brackish water and rather warm ranging of 25°-30° water temperature. This has a rich fish fauna including freshwater and brackish water fishes.

TSUKAHARA, HIROSHI, 1954: Breeding Habits of the Freshwater Sucker, *Abbottina rivularis* (BASILEWSKY). J. J. I., 3 (3-5), pp. 139-143. (in Japanese).

The writer mentions the breeding habits of *Abbottina rivularis* (BASILEWSKY). The spawning season lasts from the beginning of March to early May. The male in the breeding season has pearl organs on the snout, anterior cheek, pre-opercle and outer margin of pectoral fins. Dusky and yellow nuptial coloration appears on the body. The male prepares a nest on the muddy bottom in the shape of a round, shallow depression. The female deposits about 4,000 eggs in this nest and the male guards them until the post-larval stage, about 10 mm in total length. The egg is spherical, 1.4 mm in diameter the surface of whose jelly coat is covered with mud.

YAMAMOTO, TOKI-O, 1954: Cortical Changes in Eggs of the Gold-fish (*Carassius auratus*) and the Pond Smelt (*Hypomesus olidus*) at the Time of Fertilization and Activation. J. J. I., 3 (3-5), pp. 162-170. (in Japanese).

The author made the observation of the numerous cortical alveoli embedded in the unfertilized eggs of the gold-fish and the pond smelt. The most prominent feature of the cortical changes at the time of fertilization is a wave-like release of the content of cortical alveoli into the interstice between the plasma membrane and the preexisting egg membrane. This change and the subsequent separation of the egg membrane begin at the animal pole and end at the vegetal pole. The separation of the egg membrane is due to a colloid osmotic pressure of the perivitelline fluid which is derived from cortical alveoli. Essentially similar cortical changes are induced when ripe unfertilized eggs are immersed in distilled water, freshwater or M/7.5 RINGER's solution which is nearly isotonic to eggs. This may be regarded as an activation. Time required for completion of cortical changes is dependent on salt concentration of the media. In the egg of the gold-fish, it requires about 5 minutes in distilled water or freshwater whereas it is 20 minutes in M/7.5 RENGER's solution (20-22°C). The same is true when inseminated (dry method) eggs are immersed in distilled water, freshwater or RINGER's solution. In distilled water or freshwater, released content of cortical alveoli remained as opaque granules in the perivitelline space for a considerable period of time. In RINGER's solution they soon disperse in the perivitelline space. No cortical changes of the unfertilized eggs take place when an isolated ovary is kept in a moist chamber. Auto-activation is inhibited in the ovary or in the ovalian fluid. In the isotonic solution of sodium oxalate (M/11) which precipitates Ca ions, cortical changes are reversibly inhibited. When unfertilized eggs of gold-fish are activated by immersing them in freshwater for 5 minutes and then inseminated in the solution, a few eggs are fertilized and developed into embryos. This shows that the sperm can enter the egg in which the cortical changes are nearly completed.

YAMAMOTO, TOKI-O, 1954: Physiological Studies of Fertilization and Activation of Fish Eggs. Exp. Cell Resear. 6 (1), pp. 56-68.

The author makes a research on the fertilization and Activation of *Aplocheilus latipes*. He concludes as follows. A few unfertilized eggs (5-6%) of the *Aplocheilus latipes* reveal auto-activation in the isotonic RINGER's solution. The percentage of autoactivation markedly decreases in Ca-free RINGER's solution. No eggs show auto-activation in an isotonic solution or in oxalated RINGER's solution. When unfertilized eggs are treated with isotonic oxalate solution they lose the capacity for cortical changes on stimulation when transferred to RINGER's solution. The presence of calcium ions favors the cortical response of eggs on stimulation with sodium oleate and saponin. Only a few eggs show activation if the eggs are first treated with these chemical agents dissolved in Ca-free RINGER or oxalate-solution and then transferred to Ca-free media. The reactions of an exudate of cortical protoplasma with sodium alizarin sulfonate indicates that free calcium ions are released from the cortical proto-

plasm at the time of stimulation with pitching. Anesthetized eggs reveal only a slight reaction with the dye. Calcium ions are not necessary in the primary phase of activation, but they are released from the cortical protoplasm at this phase. Calcium ions are necessary or at least have a favorable effect in the secondary phase of activation. The cortical changes involved in activation of *Aplocheilus* eggs may be expressed by the following catenary reactions: Simulants→stimulation→fertilization-wave→breakdown of cortical alveoli→release of colloid from alveoli → separation of egg membrane. Calcium ions are released in stimulation and they may be necessary for the establishment of the fertilization wave which causes the breakdown of the cortical alveoli.

1955

DÔTU, YOSHIE, 1955: The Life History of a Goby *Chaenogobius urotaenia* (HILGENDORF). Scie. Bull. Facult. Agric. Kyûshû University, 15 (3), pp. 367–374.

The writer studies the life history of *Chaenogobius urotaenia* (HILGENDORF). This gody is small and polymorphic, common in the rivers and lakes of Japan, and also distributed in Korea, Manchuria, Siberia and Saghalien. During the spawning season, extending from January to May in Kyûshû, a nuptial coloration appears in the mature female. The number of the ovarian eggs is 885–2,257. They are deposited on the stones on the bottom in a rapid stream. Eggs are ellipsoid in shape, adout 3.0 mm in length, and 1.0 mm in width, demersal and adhesive with a bundle of adhesive filaments; incubation period is about 14 days at the temperature of about 15°C. The newly hatched larva was 4.1mm in total length, with large melanophores on its body-sides; and its yolk was consumed in 7 days. The larva likes to descend into the sea, staying a few months in the coastal water. They are carrying a pelagic life, feeding on pelagic copepods and amphipods.

When larvae, about 25 mm in total length, they start to ascend the river in shoals and soon enter into the bottom life in the river. They may be become adults in no less than 3 years.

DÔTU, YOSHIE and MITO, SATOSHI, 1955: On the Breeding Habits of the Larvae and Young of a Goby, *Acanthogobius flavimanus* (TEMMINCK et SCHLEGEL). J. J. I., 4 (4–6), pp. 153–161.

The writer studies on the life history of a very common gody (*Acanthogobius flavimanus*) and mentions in this report. In Kyûshû the spawning-season extends over January to March. The breeding-room, somewhat flat Y-shaped, is constructed vertically in the tidal flat deposit and with two entrances. The deposited egg are attached to the wall of the upper part of this room. The egg is club-shaped, measuring about 5.5 mm in length and 0.95 mm in width, with adhesive filaments around the basal end. The incubation-period extends about 28 days at the temperature of about 13°C. The newly hatched larva is about 4.6 mm in total length. The young, 15–20 mm in total length, were obtained from the bottom of estuaries.

EGAMI, NOBUO, 1955: Effect of Estrogen and Androgen on the Weight and Structure of the Liver of the Fish, *Oryzias latipes*. Ann. Zool. Jap., 28 (2), pp. 79–85.

The author experimented the effect of estrogen and androgen on the liver of *Oryzias latipes* and concluded as follows. In the breeding season, the livers of normal specimen exhibit sex-linked differences in weight, coloration and histological structure. Implantation of an estrone pellet in male fish and a testosterone propionate pellet in female fish causes a transformation of the structure of the liver to that resembling the organ of the opposite sex. In sexually inactive season, the livers are of the male type in both sexes and estrone is incapable of modifying the structure of the organ.

EGAMI, NOBUO, 1955: Production of Testis-Ova in Adult Males of *Oryzias latipes*. V. Note on Testis-Ovum Production in Transplanted Testes. Ann. Zool Jap., 28 (4), pp. 206–209.

The author makes an observation concerning the testis-ova in the transplanted testis. Generally the testes transplanted to ovariotomize females of the fish, *Oryzias latipes*, oocyte-like cells are often encountered. In the majority of cases reported from the previous investigations, however, the origin

of the testis-ova was not thoroughly worked out. The possibility cannot be excluded that the cells were derived from ovarian remnants. In his experiment, testis-ova were produced, though not frequently, in testicular transplants in the castrated male fish, receiving no treatment with estroganic substance. The testes invariably underwent degeneration to some extent about 10 days after the transplantation, but in 5 to 7 weeks they gradually became enlarged and regained their activity, when the transplantation were successful. Irrespective of the sex of the host, testis-ova were formed in the grafts while these were regaining their spermatogenetic activity. These findings seem to support my previous conclusion that testis-ova are formed in the damaged testes during the restoration of the spermatogenetic activity, and that the formation of testis-ova can be initiated by any factors causing a temporary testicular degeneration.

HARA, MAMORU, 1955: Notes on the Variation found in Fishes (2). Collecting & Breeding, 17 (2), pp. 48–49. (in Japanese).

The writer mentioned many abnormalities of *Zacco platypus* collected at upper part of Ôogi River Otakamachi, Chita-gun, Aichi Prefecture on July, 1935.

HIKITA, HIROCHIKA, 1955: On an Aberrant Form of Chun Salmon taken from the Northern Pacific Ocean and some Examples of Salmonoid Fishes in Hokkaidô. Sci. Rep. Hokkaidô Fish Hatch., 10 (1, 2), pp. 63–71. (in Japanese).

The writer reports the abnormal forms of Chun Salmon which were collected from the Northern Pacific on June 14, 1954 by the Ginyô Maru Fleet of the Hokkaidô Fishery Co. & Ltd. and from the various rivers of Hokkaidô by local officers.

HIKITA, TOYOHIKO, 1955: An Aberrant Form of the Dog-Salmon with Abnormal Scales. J. J. I., 4 (4–6), pp. 133–135. (in Japanese).

The writer informs an aberrant form found in a drag-net at Harockamui seashore at the mouth of the Ishikari river on October 18th, 1954. This form is raerly found in waters around Hokkaidô.

HIRAO, SHÛICHI, YAMADA, JUAMI and KIKUCHI, RYO, 1955: Relation between Chemical Constituents of Rainbow Trout Eggs and the Hatching Rate. Bull. Jap. Soc. Sci. Fish., 21 (4), pp. 240–243. (in Japanese).

These authors reported already that the components of iron and of a kind of carotenoidviolaxanthin were low in the eggs of Rainbow Trout sanpled from poor hatching broods. In this report, the authors mention another observation on the samples supplied from the Fuji-Trout Hatchery together with the data of their hatching rate. As for the present samples, the component of iron was found to be proportional to the hatching rates. There is also a tendency that Vitamin B_2 content in the eggs of high hatching rate is slightly larger than that in those of low hatching rate.

HIROSE, HATSUHIKO and YANADA, TSUKASA, 1955: Notes on the Variation found in Fishes (5). Collecting & Breeding, 17 (11), pp. 341–342. (in Japanese).

The writers described several abnormal specimens of *Gnathopogon elongatus*, *Acheilognathus limbata*, *Rhodeus ocellatus* and *Cyprinus carpio*. They were mostly collected from a stream, Narumi-machi, Aichi-gun, Aichi Prefecture. In *Acheilognathus limbata*, a curved vertebrae abnormality was found. In *Rhodeus ocellatus*, a branched oviposìter was found.

HOMMA, YOSHIHARU and MUKAMI, SHINJURÔ, 1955: Effects of Thyroxine and Thiourea on the Development of Chun Salmon Larvae (*Oncorhynchus keta*). J. J. I., 4 (1–3), pp. 83–93. (in Japanese).

The thyroid glands of European eel and flat fish are effected the metamorphosis just like that of the frog. These facts also extend to the melanophoric formation in the fish. From these facts, the authors

made the following experiments. In the A series, thirty chun salmon alevins obtained at Aganogawa hatchery, Niigata Prefecture, were immersed in the solution of 1/1,000,000 of thyroxine and 1/3,000 of thiourea, respectively, for six weeks immediately after hatching, and in the Bseries, thirty alevins were immersed in the solution of 1/12,000,000 of thyroxine for seven weeks, one week after hatching, the effects of these treatments to salmon larvae were observed. The same number of control groups were held in tapwater under identical conditions. He obtained the following results. 1. In the both series, a marked inhibition in weight increase namely, the gronth rate and also a delaying of the rate of absorption of yolk sac were observed. In the body form of the larvae treated by thyroxine, the breath of head, such as protrusions on the top of the head as well as posterior edge of the opercular and enophthalmon like conditions, was observed. But the developments of the trunks, caudal, and fins, except elongated pectoral fins were very poor. These modifications were more remarkable in the B series. The marked changes were not observed in the larvae treated by thiourea, besides the immature characteristic which were somewhat kept in the body form. In the both series, the coloration of the larvae treated by thyroxine showed a pallor, namely, premature silverication, which was produced by thiourea showed no change. In the control fish, the histology of thet hyroid gland showed a figure of functional and hyperactivity with cuboidal epithelium and vacuolized colloid. On the contrary, the thyroid gland of the larvae treated by thyroxine in the both series appeared in the hypofunctioning figure with flattened epithelium and dense colloid. While the thyroid of the larvae treated by thiourea revealed pathological hyper-functioning with obvious hypertrophic columnal epithelium, number increase and size decrease of follicles, and back of colloid. Furthermore, hypertrophic cells of pituitary also observed in the thiourea treated fish.

INOUE, KIHEIJI, 1955: Experiment upon the Nocturnal Behavior of Freshwater Fishes. 1. Jap. J. Ecol., 4 (4), pp. 156–157. (in Japanese).

The writer made some experiments on the nocturnal behaviors of 15 species of freshwater fishes. The experiments were carried out at the ponds of Yamada, Kanki and of the Kiyotaki Hatchery of the Hyôgo-ken Fisheries Experimental Station. He observed the nocturnal behavior of the 15 species (including *Lampetra planeri*, *Salmon irideus*, *Acheilognathus rhombea*, *A. tabira*, *A. limbata*, *Tribolodon hakuensis*, *Moroco steindachneri*, *Zacco temminckii*, *Hemigrammocypris rasborella*, *Carassius auratus*, *Cyprinus carpio*, *Misgurnus anguillicaudatus*, *Sebastodes kawamebari* and *Cottus pollux*). in comparison with the behavior during the day-time by marking the fish at the front of dorsal fin with a badge, coated with self luminous greenish color paint. From his observation, he concludes that in the night time most of the fishes is apt to disperse and to show slow movement, and inactive and swim near water drainage against water-intake. In *Cottus kajika* and other two species are always inactive in all the time, while *Zacco temmincki* rather active in nigth time.

ITÔ, SHIZUO, 1955: Studies on the Effect of Hydrogen Ion Concentrations upon the Activation of Eggs of *Plecoglossus altivelis*. Kumamoto Jour. Sci.,* B. 2, 2(2), pp. 230–238.

The specimens were collected at River Midori, Kumamoto city, on October and December, at the breeding season. The eggs are activated gradually in hypertonic (M/4) and isotonic (M/7) RINGER's solutions adjusted to pH 7.0–7.3. And the activation of eggs in inhibited in isotonic RINGER's solution of alkaline side (pH=7.8–9.4). It is reversible within 2 or 3 hours, and it is accelerated in the same solution of acid side (pH=3.0–5.2). In the alkaline water (pH=8.6–9.8) also, the activation is more retarded than in tap water. He concluded that the activation of "Ayu" eggs is affected by hydrogen ion concentrations of outer media.

ITÔ, SHIZUO, 1955: Studies on the Effect of ovarian and other organic Fluids upon the Activation of Eggs of a Freshwater Fish, *Plecoglossus altivelis*. Zool. Mag., 64 (10), pp. 312–315. (in Japanese).

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* Kumamoto Jour. Sci.=Kumamoto Journal of Science published by the Kumamoto University. Kumamoto, Kyûshû.

The author studied the effect of ovarian and other organic fluids upon the activation of eggs of *Plecoglossus altivelis*. Whereas the activation takes place gradually in hypertonic or isotonic RINGER's solution (pH=7.0–7.3), the eggs immersed in the ovarian fluid remain intact. When the organic fluids are diluted with m/7 RINGER's solution, M/3.5 glucose or distilled water, activation occurs in the diluted media lower than 1/10 (glucose, D. W.) and 1/40 (RINGER). When organic fluids are dialyzed, activation takes place in the non-dialysate, but it dose not occur in the dialysate. Activation occurs also in the other colloidal RINGER's solutions (gum=arabic, albumine dissolved in M/7 RINGER). When some amounts of N/10 HCL are added to the dialysate, activation occurs. This seems to indicate that the inhibition of activation is due to the Alkaline media or the higher salt concentration of ovarian and other organic fluids. But there are some differences between organic fluids (ovarian fluid etc.) and their crystal parts or alkaline RINGER's solution. In the former, activation is inhibited reversibly for some hours, while in the latter, the ability of activation is lost inreversibly for the same time. Therefore, it is considered that the colloid substance of these organic fluids takes part in the inhibition of activation.

KOBAYASHI, HIROMU, 1955: On the Hermaphroditic Loach, *Lefua nikkonis* (JORDAN et FOWLER). Ann. Zool. Jap., 28 (1), pp. 17–18.

The writer found a case of hermaphroditic loach, captured at Shin-Kotoni, Sapporo, Hokkaidô, in May, 1954. In this specimen, he found the ovaries composing many mature ova and the testes having spermatids, spermatocytes and spermatozoa.

KOBAYASHI, HISAO, 1955: Comparative Studies of the Scales in Japanese Freshwater Fishes, with Special Reference to Phylogeny and Evolution. J. J. I., 4 (1–3), pp. 64–75. (in Japanese).

In the present paper, the author discussed the phylogenies of *Salmonidae* and *Thymallidae* of *Japan*, including the genera, *Oncorhynchus*, *Salvelinus*, *Salmo*, *Hucho*, *Thymallus*, *Osmerus*, and *Hypomesus*.

KOBAYASHI, HISAO, 1955: Prefectural Park of the Northern Mountain Region of Aichi Prefecture and the Freshwater Fishes in its Vicinity. Hokusetsu Sangaku Hôraijisan Kenritsukôen Ittai no Shizenkagaku Chôsa Hôkoku*, pp. 85–88. (in Japanese).

In this short report, the writer mentions 32 species of freshwater fishes in this region.

KOBAYASHI, HISAO, 1955: Notes on the Variation found in Fishes (3). Collecting & Breeding, 17 (7) p. 215. (in Japanese).

The writer found a *Zacco teminncki* (T. et SCH.) without ventral fin. The specimen was obtained at a branch of Toyokawa River, Aichi Prefecture.

KOBAYASHI, SHINJIRÔ, 1955: Changes in Catalase Activity of the Tissues and Blood of "Masu" *Oncorhynchus masou*, when transferred from Freshwater to Sea Water. Bull. Fac. Fish. Hokkaidô Univ., 6 (1), pp. 1–6.

The writer reports the results of an experiment performed to find whether some changes of the catalase activity of the tissues and blood in the smolts of *Oncorhynchus masou* occurred when they were transferred from freshwater to sea water. He also mentions the seaward migration of this species, smolts used at that time were of physiologically marine form.

KUBOTA, ZENZIRÔ and MATSUI, ISAO, 1955: Morphological Studies on the Loach, *Misgurnus anguillicaudatus* 1. On Morphological Difference closely related to Sex Determination. Jour. Shimonoseki Coll. Fish., 4 (1), pp. 69–77. (in Japanese with English summary).

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* Hokusetsu Sangaku Hôraijisan Kenritsukôen Ittai no Shigenkagaku Hôkoku=Report of the Natural History Research around Mt. Horaiji Prefectural Park, Aichi Prefecture.

The author report new morphological facts for the specific determinaton. They mention the following facts. 1) The dorsal fin of the female is located more backward than that of male. 2) Bases of dorsal and anal fins of male are longer than those of female. 3). Caudal peduncle of male is higher than that of female. 4). Barbels of male are longer than those of female. 5). Gape of female is larger than that of male, and lip of female is more roundish than that of male. 6). Snout of male is longer than that of female, and it is more acute in male than in female.

KUBOTA, ZENZIRŌ and **MATSUI, ISAO,** 1955: Influence of Temperature on the Length of Hatched Fry of the Loach, *Misgurnus anguillicaudatus* (CANTOR). Jour. Shimonoseki Coll. Fish., 4 (2), pp. 225–230. (in Japanese with English summary).

The writers make some experiments on the relation between the water temperature and the growth of fries of loach. They mention the average total length of fry hatched at 14.9°C, is 2.79 mm after 48 hours it attains 3.45 mm in total length. Within the range of mean deviation 1.2°–14.5°C in the series of temperatures 3.1–32.0°C, the larger the temperature deviation was, the less the total length of hatched fry, the hatching rate and the time required for hatching become. The relation between the total length (L') of hatched fry in case water temperature (O) kept constant and the corresponding one (L) of hatched fry exposed to varying water temperature may be expressed by the following formula: $\log L/L' = kM^2 + c$ Thus they have $k = 0.00075$, $c = 0.0025$.

KUBOTA, ZENJIRO and **MATSUI, ISAO,** 1955: On the Decreasing Rate in Weight and Number of the Loach (*Misgurnus anguillicaudatus* CANTOR) during the Winter Season. Journ. Shimonoseki Coll. Fish., 4 (3), pp. 327–337. (in Japanese with English summary).

The writers make an experiment on the relation between the stockinq density and decreasing rate of loaches cultured at the sunny places or in the shade. The most important factor of controlling the decreasing rate is not number of fish, but weight of it, and the decreasing rate in controlled by temperature, namely the higher the temperature is, the larger the decreasing rate ensues.

KUBOTA, ZENJIRÔ and **MATSUI, ISAO,** 1955: Morphological Studies on the Loach, *Misgurnus anguillicaudatus* (CANTOR) II. Changes of Shape with Advance of Growth, Jour. Shimonoseki Coll. Fish., vol. 5, no. 2, pp. 117–135. (in Japanese).

They study the changes of shape during the stages of the larva and adult of the loach. Coefficient values of frontal edge of eye-ball, back end of opercle, respective insertions of dorsal fin, ventral fin, and anus are smaller in adult than in fry of the loach. The proportion of snout length to head length is higher in adult than in fry. Coefficients of fin length are larger in fry than in adult, and the highest value is obtained when 1.0–2.9 cm in body length. The difference between adult and fry in relation to the coefficients in general is nullified when the fish is over 7cm. in body length. This stage corresponds to the time of the appearance of sexual characters. It seems that the period when the coefficients case to differ from those of adult stands in close relation to maturity and general activities.

KUBOTA, ZENJIRÔ. MATSUI, ISAO and **SAKANE, HIROSHI,** 1955: On the Early Development and Growth of Scale of the Loach, *Misgurnus anguillicaudatus* (CANTOR). Journ. Shimonoseki Coll. Fish., vol. 5, no. 3, pp. 175–187. (in Japanese).

They study the early development and growth of the scale of the loach. The scale appears on the larva measured 1.91 cm in body length and completes when the larva attained 2.7–3.0 cm long. The scale coefficient is understood here to imply either the ratio of scale length or width to body length. The relation between scale coefficient to body length is represented by a curved line when the fish is small, but coefficient becomes constant in the specimens over 8 cm in length. The relations of the length and width of scale and number of circuli are represented by straight lines. The regeneration rate of scale is larger in posterior part of the body. The relation between the length of scale ($S\mu$) and number (Y) of annual rings is expressed by $S = 419.5\ Y^{0.6232}$.

MAETANI, SHIGEO, 1955: Japanese Fisheries. Published by the Sangyô Keizai Shimbun, Tôkyô, pp. 1-133.

This report is compiled by the Fisheries Agency of Japan and many problems are mentioned briefly by their authorities. As to the freshwater fisheries and cultures, Dr. K. KURONUMA mentions the fish culturing in freshwater pools. The main aquatic fishes raised in inland water in Japan are as follows: *Cyprinus carpio*, *Carassius auratus*, *Anguilla japonica*, *Salmo gaidneri*, *Salvelinus fontinalis*, *Plecoglossus altivelis*, *Mugil cephalus*, *Carassius auratus* var.

MAKINO, SAJIRÔ,. OJIMA, YOSHIO and MATSUI, YOSHIICHI, 1955: Some Cytological Feature of Sterility in the Carp-Fauna Hybrids. Ann. Zool. Jap., 28 (1), pp. 12-16.

The authors make a research on the Carp-Fauna Hybrids. When kept under confined conditions, the carp *Cyprinus carpio* and the "Funa" (*Carassius auratus*) mate and can produce hybrids. Reciprocal crosses are also possible with similar results. The hybrids grow regularly with no observed anomalies in their developmental course. The hybrid males are completely sterile. Their testes generally lack spermatogenetic activity. The chromosomes as observed in spermatogonial division are 99 in number, being the total sum of the haploid number of the parents, 52 for the carp and 47 for the "Funa". Meiosis in the hybrid testes is highly disturbed, being arrested at the early stages of the meriotic prophase. Most of germ cells undergo pycnotic degeneration during the period from late leptoene to pachytene, and no spermatozoa are produced. In some hybrid specimens, the gonads show mosaic structures composed of testicular and ovarian elements, an evidence suggesting that steriiity is associated with intersexuality caused by genetic unbalance between the parents.

MARUYAMA, KOSCAK and ISHIDA, JURÒ, 1955: Effect of 2,4 Dinitrophenol and Azide on the Latent Apyrase Activity of the Fish Embryo., Ann. Zool. Jap., 28 (3), pp. 131-136.

It is known that 2,4-dinitrophenol (DNP) is as an uncouphing agent of oxidative phospharylation, usually retords embryonic development of animals despite the fact that it is capable of accelerating the respiration. The authors have reported the antagonistic of DNP and azide on the latent apyrase activity of the toad egg during embryonic development. Here they make a similar experiment on the early embryos of the *Oryzias latipes*. The sensibility of apyrase to these two reagents was found to be variable according to the stage of embryonic development and the sensitive stages differ between fish and toad embryos.

MATSUI, ISAO, 1955: On the Species and Distribution of Japanese Eels collected in the Pacific Region and its Adjacent Waters. Bull. Biogeo. Soc. Japan, vols. 16-19, pp. 282-292.

The author reviewed the Japanese eels and classified them into two species *Anguilla japonica* and *Angiulla marmorata*. He took *Anguilla mauritiana* under the synonyme of *A. marmorata*. The northern limit of the distribution of *A. japonica* is located at Hakodate or Horobetsu pointed out by the authorities of the Bureau of Fisheries of Japan. The northern limit of distribution of *A. marmorata* is Quelpart Island in Korea and Joga Ike in Japan and the southern limit is Natal in the South East Africa. The natural distribution has been influenced by the Japan Current.

MINAMORI, SUMIO, 1955: Local Races of Spinous Loaches. Bull. Bio. Geo. Soc. Japan, vols. 16-19, pp. 277-281. (in Japanese).

The writer studies local races of Spinous Loaches which make a confusion of the specific name systematically. They are divided into many physiologically isolated local races. The strength of isolation between any two races is generally in parallel with the differences in body length and size of cells, like eggs, spermatozoa or blood cells. Accordingly, if much importance should be attached to the physiological isolation for a classification of the spinous loaches, it seems to be advisable that the differences in the above-mentioned characters are taken into account together with the differences in color-pattern and lamina circularis which have hitherto been used.

MINAMORI, SUMIO, 1955: Physiological Isolation in Cobitidae. III. Hybrid Sterility and Hybrid Breakdown in Contact Regions of Two Races of the Striated Spinous Loach. J. J. I., 30 (6), pp. 243-251. (in Japanese).

The writer continously describes this investigation intending to clarify whether the isolating mechanisms would be especially strengthened or not in overlapped regions of the distribution areas of *Cobitis taenia striata* IKEDA.

NAKAMURA, NAKAROKU, 1955: Comparison of the Carp and the Crucian Carp from Piscicultural Point of View. Bull. Jap. Soc. Sci. Fish., 21 (2), pp. 77-81. (in Japanese).

The author carried out the study on the comparison of the carp and the crucian carp in loosely diffused culture from the ecological characteristics. The survival rate of the crucian carp is always higher than that of the carp, and rearings of the crucian carp grow faster than the other in such circumstances as without supply of enough food. While there occurs unevenness of growth among the batch of carps, the crucian carps grow always rather evenly. The different feeding habits of the two species is considered to be an eminent factor. The carp feeds mainly on large benthos (*Chironomus* larva, etc.), while the crucian carp mosty depends on minute adhesive organisms, algae and organic detritus.

NISHIDA, HIDEO, 1955: Morphological and Histochemical Studies on the Blood Cells found in the Yolk of Salmon Embryo., Rep. Hokkaidô Fish. Hatch., 10 (1, 2), pp. 43-46. (in Japanese).

The writer finds out the remarkable and many blood cells in the yolk of embryo of *Oncorhynchus keta*. The blood cells are distributed in single or in mass adjacently the oil drops. The natures of blood cells are the absence of the cell division and the cytoplasm fused frequently into the yolk and the positiveness to the pexidase reaction.

NIWA, HAJIME, 1955: Effects of Castration and Administration of Methyl-testosterone on the Nuptial Coloration of the "Medaka", *Oryzias latipes*. J. J. I., vol. 4, nos. 4-6, pp. 193-200. (in Japanese).

The author studies the nuptial coloration *Oryzias latipes*. He makes an experiment of the effects of castration and administration of methyl-testosterone for the nuptial color of the male. Ovariotomy induces no significant change in coloration. The subcutaneous administration of methyl-testosterone to the ovariotomized and the normal females induces the manifestation of the nuptial coloration. The transplantation of the testis into a normal female induces artificial production of the nuptial coloration. Conclusively, the nuptial coloration of *Oryzias latipes* is manifested by the action of the male hormone from the active testis in the breeding season and the female hormone has no effect on the manifestation of the nuptial coloration.

NIWA, HISASHI, 1955: Notes on the Geographical Distribution of a Species of Japanese Cobitidae, *Cobitis delicata* NIWA. Bull. Biogeo. Soc. Jap., vols. 16-19, pp. 325-330. (in Japanese with English summary).

The author revised the distribution of *Cobitis delicata* in the mid-central part of Honshû, Japan. The eastern limit is lined by Hida Mountain Range and Kiso Mountain Range. The western limit seems to be in the isthmus region of Honshû. The fish spreads out into a part of the Biwa-Yodo Region over the so-called Tsuruga-Owari line and the Suzuka Mountain Range, Mie Prefecture.

NOGUSA, SHINSAKU, 1955: Chromosome Studies in Pisces V. Variation of the Chromosome Number in *Acheilognathus rhombea* due to Multiple Chromosome Formation. Ann. Zool. Jap., 28 (4), pp. 249-255.

The author investigted the chromosome of *Acheilognathus rhombea*. He found that three kayotypes; the 4 V-type (4 V′s+40 r′s), the 2V-type (2V′s+44r′s) and the 10 V-type (48 r′s), through the course of spermatogenesis. The variation in the kayotype as well as the apparent reduction of the chromo-

some number, can be explained as the result of multiple formation through centric fusion. Variations in kayotypes occurs within the individual: the same individual is characteized by two or three different kayotypes. Multiple-chromosome formation probably plays an important role in the change of chromosome number in the course of evolution.

OGAWA, YOSHINORI, 1955: Notes on the Ecological Variation of the Number of Fin-rays of wild *Oryzais* collected from Noto-District, Toyama Prefecture. Collecting & Breeding, 17 (9), pp. 274–275, 277. (in Japanese).

The writer made the observations on the variations of anal fin rays of *Aplocheilus latipes* obtained at Noto-District, Toyama Prefecture. Ranges of the fin variations exhibit 20 in maximum and 15 in minimum. The variations do not show in geographical localities.

OKADA, YAICHIRÔ, 1955: Fishes of Japan (Illustrations and Descriptions of Fishes of Japan), Maruzen Co. Ltd. Tôkyô. pp. 1–424.

The author describes and illustrates 391 species of marine and freshwater fishes which are found commonly at fish market in Japan. Nine of those belonging to freshwater fish are mentioned in this book with figures.

OUJI, MASAMI, 1955: Morphology and Development of the Hatching Glands of the Teleost, *Carassius auratus*., Zool. Mag., 64 (9), pp. 277–279. (in Japanese).

The hatching glands of the teleost are originated from different germ-layers. The writer observed this unicellular gland of crucian carp in which the glands numbered 700–800, are found in the epithelium covering the surface of the lower lateral sides of the trunk and the yolk sac. On either side of the trunk, the glandular area begins at the nostril and extends caudally to a point a little anterior to the anus. The epithelium of the greater part of the yolk sac contains the hatching glands, only that of the posteroventrai part of the sac being free from the glands. All the glands are derived from the ectodermal cells on both sides of the trunk in the areas mentioned above and the glandular cells on the yolk sac are those which are differentiated from mother cells migrating from the trunk epithelium. At the hatching out, the majority of the glands have finished discharging the cytoplasmic granular and, at one day after hatching, the fish are devoid of any glandular cells.

SATÔ, AKIRA, 1955: *Salvelinus leucomaenius* in Breeding Season. Tsuribito, 10 (2), pp. 18–21. (in Japanese).

The writer observed *Salvelinus leucomaenius* at a stream around Togakushiyama, Nagano Prefecture in the breeding season. He has noticed peculiar habits of this fish or breeding.

SATÔ, MITSUO, 1955: On the Development of the Neuromasts of the Carp *Cyprinus carpio*. J. J. I., 4 (3), pp. 105–112. (in Japanese with English summary).

The writer described the neuromast of *Cyprinus carpio* in the present paper. He has treated the development of the first primodia of the supraorbital organs and main lateral canal organs of the sense organs. They appear as placodes when the embryo is about 24 hours after fertilization. The placode sop of the supra-orbital organ streches along the dorsal edge of the optic vesicle, and the rudiments of the main canal organs consist of three placodes which are arranged to form a file on the trunk. These placodes are indicated by slight thickening of the epidermis in sections, but are not visible at the surface view. In 41-hour embryo, two new placodes appear. These two placodes form respectively the primodium of the infra-orbital and operculo-mandibular canal organ. The one placode appears behind the optic vesicle and the other in the front of the auditory vesicle. The pit organs are formed by the above-mentioned process project considerably out of the surrounding epidermis, and they are easily recognized as white projections microscopically. The canal organs, however, begin to sink under the epidermis and to be enclosed in the canal, through the similar process. But, the pit organs do not sink under the epidermis.

SATÔ, MITSUO, 1955: Studies on the Pit Organs of Fishes. I; Histological Structure of the Large Pit Organs. Jap. Jour. Zool., vol. 11, no. 3, pp. 111-120.

The writer makes a comprehensive research in the pit organ of freshwater fishs of Japan. In this report he describes that the large pit organs are divided into two types, the "naked" and the "sunke-n". Thus *Oryzias latipes* is named the naked type ones. An embryological relation exists between the development of these two type. The large pit organs are first formed as the naked type, and as the fish grows up some of them sink into the epidermis and thus they are named the sunken type. The cupula can be discerned by the vital staining on the outer surface of the groove organ in *Oryzias latipes*. This is easily broken off or easily changeable.

SATÔ, MITSUO, 1955: Studies on the Pit Organs of Fishes. III; The Distribution of the Large Pit Organs. Bull. Mar. Biol. Stat. Asamushi, Tôhoku Univ*., vol. 7, no. 2-4, pp. 57-68.

The writer describes the distribution of the large pit organs in the nine species. It may be considered in connection with the developmental degree of the canal line system. *Carassius auratus, Leuciscus hakuensis, Oncorhynchus keta* and *Salmo irideus* have a well-developed canal line system. *Pygosteus sinensis, Misgurnus anguillicaudatus* and *Oryzias latipes* have an undeveloped or non-existent canal line system. The large pit organs on the head generally more develop in the fishes which have imperfect canal line or none, than in the fishes with the well developed canal line. The carp has both the well-developed canal line and a lot of the large pit organs on the head. From this observation, it seems that there is no close relation between the abundance of the large pit organs on the head and the existence or development of the canal line. The fishes with a number of large pit organs on the trunk are very few.

SATÔ, RYUHEI. USUKI, ITARU and **SHIRAISHI, KAGEHIDE,** 1955: On the Limnological Conditions and the Spawning Nests of Land-locked Sockeye Salmons in Lake Tsuta-Numa. Ecological Review**, 14 (1), pp. 66-67.

The writer makes an experiment of the transplantation of the Land-locked Sockeye Salmons in Lake Tsuta Numa which is located, 480m above sea level, in Aomori Prefecture. He recognizes the land-locked sockeye salmon establishes itself there, feeding principally on *Daphnia longispina,* and spawns in autumn every year. Actually the author could find on November 3rd, twenty fertilized eggs on the bottom at the depth of lmm or so. They were coverd with a layer of gravels and sand in the depth of about 10cm.

SAITÔ, SABURÔ, 1955: On the Mechanism of the Appearance of the Scale Structure. III. On the Regeneration of the Scales of Crucian Carp, *Carassius carassius* (L.), when They are reared with Different Food. Bull. Fac. Fish. Hokkaidô Univ., vol. 5, no. 4, pp. 332-335. (in Japanese).

The author makes the experiments with the relation of nutrition to the growth of scales by the regeneration of scales under the conditions of food. From the experiments, he concludes that the regeneration is not always affected by the nutrition, Furthermore he admits that the absorption of the bony layer under starving conditions is not recognized at all.

SAITÔ, SABURÔ and **YOKOI, KANAME,** 1955: On the Freshwater Catfish, *Parasilurus asotus* (LINN.) from Hokkaidô. Bull. Fac. Fish., Hokkaidô Univ., 5(6), pp. 336-337. (in Japanese).

The distribution of *Parasilurus asotus* (LINN.) in Hokkaidô is somewhat doubtful. The writers confirm that it lives naturally in a part of Hokkaidô, some restricted area north of Asahigawa City, far from the south-most part, and they guess that it may possibly live widely in Hokkaidô.

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* Bull. Mar. Biol. Stat. Asamushi, Tôhoku Univ.=Bulletin of tho Marine Biological Station Asamushi attached to the Tôhoku University. Asamushi. Aomori Prefecture.

** Ecological Review = Ecological Review published by Mt. Hakkôda Botanical Laboratory attached to Tôhoku Imperial University, Sendai, Miyagi Prefecture.

SHIRAISHI, YOSHIKAZU. KITAMORI, RYONOSUKE and KITAMORI, MASAE, 1955: The Growth of Pond-Smelt, *Hypomesus olidus* in Lake Suwa and its Lepidological Study. Rep. Fresh Fish. Lab. 4 (1), pp. 17-32. (in Japanese with English summary).

The writers study the growth of *Hypomesus olidus in* Lake Suwa, Nagano-Prefecture correlating with the lepidological research.

SUZUKI, RYÔ, 1955: Note on the Interfamiliar Hybrid Larvae between Mud Loach (*Misgurnus anguillicaudatus*) and Crucian Carp (*Carassius auratus*) or Gold-fish (*Carassius auratus*). J. J. I., 4 (1-3), pp. 50-58. (in Japanese).

This experiment was carried out by mud loach collected around Okazaki City and Crucian carp from Ashiga Ike, Tamura, Atsumi-gun. Aichi Prefecture. The author made his research to examine the mortality of the eggs and larvae as the progeny from the crossing between *M. anguillicaudatus* and *C. carassius* or between the former and *C. auratus*, and to observe morphologically external and internal characters of hatching larvae. At the gastrula and the hatching stage, more striking increase of mortality was shown in interfamiliar crossing eggs and larvea than in normal ones; moreover, all these hybrids died in 3-20 days after hatching. In almost all of these hybrids, some kind of sap began to fill in between the epidermis and the yolk, causing the edema. Observing the sections of these hybrids, I found that these were conspicuous obstacles of development in the pronephric duct and pronephric chamber, the results being either collapsed ones or their non-existstence. However, in those hybrids which were free from the edema, the pronephric system was found normal. Again, in some hybrids he observed the hypertrophy of pronephric duct, thought in the case only where one side of the nephric duct was closed or not present at all. But, in the case where hypertrophy of pronephric duct continued to the anus, the larva was found free from the edema. From the above mentioned facts, I think that causes the edema is the obstacle in the excretory function of pronephros. On the other hand, hybrids which had not obstacles of development in the pronephric system could live for 10-20 days after hatching, while all the edematous larvae died in 3-5 days. From this, I think that the edema is one factor of the death in these hybrids. Again in many hybrids, I found striking obstacles of development in the tail, abdomen, heart, notochord and blood vessel causing a great irregularity in the pulsation of heart, and the inability of swimming and feeding in the hybrids. From his experiment, he concluded that the death of hybrid is caused not by the edema solely, but many factors are working at it.

SUZUKI, RYO, 1955: Notes on Hermaphroditism of Spinous Loach (*Cobitis biwae*) and Crossing between this Fish and Mud Loach (*Misgurnus anguillicaudatus*)., Zool. Mag., 64 (7), pp. 229-231. (in Japanese).

In the present paper, he described a case of functional hermaphroditism in the spinous loach and the crossing between this fish and the mud loach. The ratio between the pectoral fin length and the body length of this fish was between those of male and female. But the lamina circularis, which is peculiar to the normal male, could not be observed, and moreover, the width of this second pectoral fin ray was narrower and its length shorter than those of the normal one. Although most eggs of the hermaphrodite were destroyed when immersed in the freshwater and the egg membrane separated. But the latter eggs could not be fertilized with those spermatozoa of the same hermaphrodite. The artificial fertilization and ensuing development of eggs of mud loach inseminated with spermatozoa of the hermaphrodite were successful. This shows that the spermatozoa of this fish were normally functional. All the hybrid larvae were deformed, while many of them died soon after the hatching, the rest died when they grew as long as 13-16 mm. This may be due to the lethal gene introduced by the crossing of the mud female and the spinous male.

TAKAHASHI, NISUKE, 1955: On the Influence of the Waste Liquid, drawn out of the Alcohol Factory, upon the Development of the Eggs of *Cyprinus carpio* L. and of *Plecoglossus altivelis* TEMMINCK et SCHLEGEL J. J. I., 4 (3), pp. 16-24. (in Japanese).

The writer made the experiments on the influence of the waste liquid, drawn out of the alcohol factory located at Kumamoto City, Kumamoto Prefecture, Kyûshû upon the development of the eggs of *Cyprinus carpio* and of *Plecoglossus altivelis*. The limited concentrations of the waste liquid, in which the eggs of *Cyprinus carpio* and *Plecoglossus altivelis* are possible to hatch, are 1/50 and 1/400 respectively. The ratio of the resistant forces of the eggs of *Cyprinus* and of *Plecoglossus* for the waste liquid may be recognizable to be 8 (*Cyprinus egg*): 1 (*Plecoglossus* egg).

TAKATA, HARUO, 1955: The Maturity of Spring Herrings based on the Histological Observations of Testes., Zool. Mag., 64 (5), pp. 154-156. (in Japanese).

The writer made the histological observations on the testes of spring herrings collected at Gunbetu, Hamaeki-gun, Ishikari Province, Hokkaidô on the end of March of 1935. The maturity was well recognized by the reduction of thickening of the cyst-walls of testes with the decrease in number of immature sperm.

TANAKA, KOJIRO, 1955: Observation on the Length of the Digesting Time of Food by the Mud Loach, (*Misgurnus anguillicaudatus*)., J. J. I., 4 (1-3), pp. 34-39. (in Japanese).

The author used *Viviparus malleatus* and *Penacopsis* (red shrimps) for this experiments. In the case of the experiments for loach (*Cobitis*), the time of digestion of *Viviparus malleatus*, needed is 20 hours while that of *Penacopsis* is 24 hours.

UEDA, KAZUO, 1955: Stimulation Experiment on Fish Melanophores. Ann. Zool. Jap., 28 (4), pp. 194-205.

The writer made some experiments or the contraction and expansion of the melanophores of teleost fish under the controling melanophore nerves. His investigation is carried out to determine physiologically the distribution of melanophore nerves and to study the action of electric stimulation or such contraction inducing agents as KCL and adrenalin on the melanophores in the skin of an isolated caudal fin and scale. He used the freshwater fishes, *Gambusia* sp., *Pseudorasbora* sp. and *Oryzias latipes* for his experiments. He summarized his experiments for the responses of melanophores, caused by A. C. or stimulating agents such as adrenalin and K in the isolated fins or scales of the freshwater fishes above-mentioned. Contractions caused by application of A. C. are due to stimulation of underlying nerve fibers. They may be induced by contracting hormones secreted from the terminals of the melanophore contracting nerves. The results obtained from A. C. stimulation of the melanophore contracting nervous system following incisions in various parts of isolated caudal fins or scales indicate the cause taken by melanophore contracting nerve fibers. These run generally parallel to the fin rays, without sending branches into the interradial membranes or adjacent rays. Antidromic response exhibited by the contracting nerve fibers in the fin ray may be attributed to the activities of their proximal branches. Upon the basis of partial treatment of the fin ray with adrenalin or K that these agents act directly on the melanophores and induce their contractions. No part of the melanophore nerve system seems to take part in the response.

UMEMURA, JUNJI, 1955: Notes on the Variation found in Fishes (4). Collectiag & Breeding, 17(10), pp. 300-301. (in Japanese).

The author described many examples of abnormal *Plecoglossus altivelis*. The specimens were obtained at Yahagi River, Aichi Prefecture. The examples mostly exhibit a shortening abnormality.

WATANABE, MUNESHIGE, 1955: Study of the Annules of the "Gengorô-Buna", One of the Races of *Carassius auratus*., Bull. Fac. Fish. Hokkaidô Univ., 6 (2), pp. 176-184. (in Japanese with English summary).

The writer studies the annules of the scale of the special races of a crucian carp. He informs the main results as follows: 1) One clear winter ring is regularly formed between the first and second

summer zones. 2) Construction of the annules by the circuli is different between the anterior and lateral parts of the annules. 3) A, B and C types are recognized. 4) The season of the formation of the annules is considered to be the spring when the scale begins.

WATANABE, MUNESHIGE, 1955: Some Observations on the Eggs of the Mature Salmon (*Oncorhynchus keta*) in Hokkaidô, with Special Reference to the Race of Salmon as characterized by the Size of their Eggs., Sci. Rep. Hokkaidô Fish. Hatch., 10 (1, 2), pp. 7-20. (in Japanese with English summary).

The writer studies the comparison of the egg sizes of the mature autumn salmon from nine Hokkaidô rivers. He concludes that the number of eggs of a salmon increases in proportion to the size of fish. The size of the salmon egg generally increases in proportion to the body length. It is interesting to note different eggs of salmon in the different rivers. Those of the Tokachi River are very large, while those of the Chitose River are particularly small.

YAMAGUCHI, MASAO, 1955: The Fish Fauna of Hachirôgata Lake, Akita Prefecture. Food Habits and Fish Production. Akita-ken Suisan Shikenjô Shiken Jigyô Hôkokusho, pp. 93-97. (in Japanese).

The writer concluded from his studies as follows. 1. 49 species of 29 family are found in this lake. 2. Most of the fish spawn in spring and summer. 3. The chief food of fishes of this lake is consisting of small crustaceans, Neomysis, the young of fishes, aquatic insects. 4. The annual production from Hachirôgata Lake forms 17.4% of the whole habitat. The production during August and December occupies 82% of the whole year production.

YAMAMOTO, KIICHIRÔ, 1955: Studies on the Formation of Fish Eggs VI. The chemical Nature and the Origin of the Yolk Vesicle in the Oocyte of the Smelt, *Hypomesus japonicus*. Ann. Zool. Jap. 28 (4), pp. 233-237.

The author carrid out the research to make clear the chemical nature and the origin of the yolk vesicle, using the oocytes of the smelt, *Hypomesus japonicus* as the material. He concluded that the yolk vesicle of the smelt contains much polysaccharide, but no proteins or lipoides in appreciable quantities. He supposed that the present yolk vesicle corresponds to PARAT's neutral red vacuole. The argentophilic bodies demonstrated of DA-FANO's method seem to play a particular role in the formation of the yolk vesicle, while the mitochondria appear to participate in yolk globule formation.

YAMAMOTO, TADASHI, S., 1955: Morphological and Cytochemical Studies on the Oogenesis of the Freshwater Fish, "Medaka" (*Oryzias lapites*). J. J. I., vol. 4, nos. 4-6. pp. 170-181 (in Japanese with English summary).

The writer studies the morphological and cytochemical changes of developing oocytes in the ovary of *Oryzias lapites*. His results are as follows. The chorion and the attaching organ contain the least protein. Oil drops of the mature eggs are formed by fusion of the fat granules which appear in the perinuclear cytoplasm of the oocyte. The cortical alveoli of the mature egg are identical with the "vesicles" which appear in the young oocyte, which are formed at first in the neighbourhood of the oocyte nucleus at the time of the appearance of fat granules. The "vesicles" in the young oocyte of the cortical alveoli of the mature egg contain at least acid polysaccharides, and from the results of cytochemical reactions and of the stairing affinity to mucicarmine, neutral red, etc. it is concluded that the polysaccharides of the alveoli exist as a form of sulfomuco-polysaccharides which is similar to the mucus found in every part of the tissue. He could not find out the lipoid wall of the cortical alveolus.

YAMAMOTO, TADASHI, S., 1955: Ovulation in the Salmon, Herring and Lamprey. J. J. I., vol. 4, nos. 4-6, pp. 182-192. (in Japanese with English summary).

The writer studies the ovulation of some fish *Oncorhynchus keta*, *Clupea pallasii* and *Lampetra japonica*.

He mentions in this report that in *O. keta* and *L. japonica* the eggs emerge directly from the ovary which has no lumen into the body cavity. The maturation processes are completed within a short range of time in *O. keta* while in *L. japonica* the maturation proceeds only in the ovulated eggs. A micropylar cell is found in the immature egg of *O. keta* but not in *L. japonica*. In two species, the emergence of an egg from the lamella of the ovary at the time of ovulation occurs in the definite preexisting region (follicular rupture) and the theca folliculi is not found there. At the time of ovulation, hypertrophy of theca folliculi and follicular cells can be detected.

YOSHII, GIICHI. WATABE, NORIMITSU and OKADA, YAICHIRÔ, 1955: Studies on the Uptake of P^{32}, S^{35}, Ca^{45} and Sr^{89} in the Tissues of Fish., Bull. Jap. Soc. Sci. Fish., Vol. 22, No. 4, pp. 240-243. (in Japanese with English summary).

The writers make an experiment of radioactive contamination of *Carassius auratus* (gold-fish) measured 2 cm. in body length. The fishes were reared for the period from one to 264 hours in water containing either one of the isotopes at various concentrations, P^{32}, S^{35}, Ca^{45}, or Sr^{89}. The other, having been left without food for 10 days, reared for the same length of time in the presence of algae, *Spirogyra* radioactivated with the above isotopes. Radioactivity absorbed directly from the water is indicated in the ratio of the activity of ashed tissues against that of the water, and the activity transferred through the algae, in the ratio against the algae. Of the isotopes taken by the fish of the former group, Ca^{45} and Sr^{89} showed the counts, in most casses, stronger than P^{32} and S^{35}, with the gill off the highest count of all the organs examined. The fact that P^{32} and S^{35} were more easily transferred into the digestive organs of the lather fish than Ca^{45} and Sr^{89} may be explained in the light of findings from electropherogram examination of the radioactive algae that P^{32} and S^{35} were absorbed in higher molecule compounds, whereas the other found in ionic from in algae.

1956

EGAMI, NOBUO, 1956: Production of Testis-Ova in Adult Males of *Oryzias lapites*. VI. Effect on Testis-Ovum Production of Exposure to High Temperature: Ann. Zool. Jap., 29 (1), pp. 11-18.

The author recently observed that the exposure of males to a high temperature brings about the degeneration of the testes. From his experiments, the exposure of adult males of *Oryzias latipes* to the high temperature 37-38°C for one to five days stimulated the discharge of spermatozoa from the testes. If these fish were returned to the place of room temperature (22-31°C), the histology of the testes completely recovered to normal. The exposure of fish to a high temperature (37-38°C) for 10 or 16 days caused severe damage of the testes, accompanying the inhibition of spermatogenesis. In the majority of such testes, the spermatogenetic activity was not restored even after keeping the fish at room temperature for a month or longer. In 33 days, testis-ova were sometimes found in the testes of these fish which had received no further treatment. If fish with damaged testes resulting from prolonged heating were implanted with an estrone pellet or kept in estridiol water at room temperature, the production of testis-ova was more markedly stimulated than in the non-heated controls receiving similar treatments with the estrogens. He concludes that testicular degeneration facilitates the production of testis-ova which the author mentioned in his paper of 1955.

HAMADA, KEIKICHI, 1956: Ecological Study of the Pond Smelt, *Hypomesus olidus* 4. On the Age of the Pond Smelt ascending into the Ishikari River. Bull. Fac. Fish. Hokkaidô Univ., Vol. 7, No. 3, pp. 213-218. (in Japanese with English summary).

The writer studies the age of *Hypomesus olidus* ascending in the River Ishikari from the sea toward the end of May. He found that the pond smelt ascending to spawn in the River Ishikari and that in the Bay of Oshoro should be recognized the very same race by their having the same body length (100 mm) and the same number of vertebrae (57 numbers).

HAMADA, KEIKICHI, 1956: Ecological Study of *Hypomesus japonicus* 1. Conclusion as to Age. Bull.

Fac. Fish. Hokkaidô Univ. 7, no. 3, pp. 219–224. (in Japanese with English summary).

This is the first report of the ecological study of *Hypomesus japonicus* by author. He has treated the age of the fish in this paper. *Hypomesus japonicus* grows to 90 to 130 mm. within a year and then spawns in rivers. The age is represented by the annual ring, which is formed in April on the scale during the spawning season. However, the annual ring does not show the age at the spawning season, for some of them are observed to have already formed the ring and others have not formed any yet at the season.

HIKITA, HIROCHIKA, 1956: Pacific Salmon (Genus: *Oncorhynchus*) known to occur in Coasts and Rivers in Hokkaidô. Sci. Rep. Hokkaidô Fish Hatch., No. 11, pp. 25–44. (in Japanese with English summary).

The writer describes 6 species belonging to the Genus *Oncorhynchus* distributed around Hokkaidô.

1. *O. tschamytcha* (WALBAUM). "Masunosuke".
2. *O. keta* (WALBAUM). "Sake, Akisake, Tokishirazu, Shirosake".
3. *O. gorbuscha* (WALBAUM). "Karafuto Masu, Seppari Masu".
4. *O. kisutch* (WALBAUM). "Gunmasu, Ginzake".
5. *O. nerka* (WALBAUM). "Benimasu, Benizake, Beni".
6. *O. masou* (BREVOORT). "Sakuramasu, Masu, Honmasu".

HIKITA, HIROCHIKA, 1956: List of Marine and Freshwater Fishes and Aquatic Animals found in Some Streams and their Mouth, Vicinities in Hokkaidô. Sci. Rep. Hokkaidô Fish Hatch., No. 11, pp. 155–170. (in Japanese with English summary).

The writer reports the result of a brief survey of the freshwater fishes in Hokkaidô. Some kinds of freshwater fishes are distributed in northern areas over to Saghalin, Kamtchatka, Marietime Province of Soviet Russia and Alaska.

HIKITA, TOYOJI, 1956: On the Anatomy and Development of Carp in Hokkaidô. Sci. Rep. Hokkaidô Fish Hatch., No. 11, pp. 65–95. (in Japanese).

The writer studies the general anatomy and development of Carp and describes it in this reports with many figures.

HONMA, YOSHIHARU, 1956: A List of the Fishes found in the Vicinity of Sado Marine Biological Station. II. Jour. Fac. Sci. Niigata Univ*., Ser. II, 2 (3), pp. 79–87.

The writer makes a research for fishes around the Sado Marine Biological Station, located in Sado Island. It is interesting to note that only 8 species of freshwater fishes are found. The Cyprinidae are much scantier than in Honshû or Main Island. The crucian carp or gold-fish and *Aplocheilus latipes* were transplanted from Honshû. The following freswater fishes are reported.

1. *Salvelinus leucomaenis.* Tassya River
2. *Plecoglossus altivelis.* 〃
3. *Carassius auratus.* 〃
4. *Tribolodon* sp. Tassya River
5. *Misgurnus anguillicaudatus* Tassya River
6. *Oryzias latipes.*
7. *Rhinogobius similis.* Tassya and Ogawa Rivers
8. *Chaenogobius urotaenia.* Tassya, Ogawa and Kitaebisu Rivers.

HONMA, YOSHIHARU, 1956: Another Catadromous Eel from the Sea of Japan. Jour. Fac. Sci. Niigata Univ., Ser. II, 2 (3), pp. 95–99.

In the Japan Sea, a catadromous eel was caught at a spot off Awashima in 1954. In this report he also describes a second eel obtained at the depth of 120 meters, off Uchino near Niigata City, on April 8th, 1955.

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* Jour. Fac. Sci. Niigata Univ. = Journal of the Faculty of Science, Niigata University, Niigata, Niigata Prefecture.

IWAI, TAMOTSU, 1956: Branchial Skeleton of the Land-locked "Ayu" *Plecoglossus altivelis* T. et SCH., Bull. Jap. Soc. Sci. Fish., 22 (8), pp. 459–462. (in Japanese).

The author redescribes in this report on the skeletal structure of the branchial apparatus of land-locked form in order to discuss the relationship between the branchial structure and feeding habits of this species.

IWAI, TAMOTSU, 1956: Development of Comb-like Teeth in a Salmonoid Fish, *Plecoglossus altivelis* T. et SCH., Bull. Jap. Soc. Sci. Fish., 22 (1), pp. 12–15. (in Japanese).

The author confirms the fact that a change occurs in the type of dentition of the jaws from conical teeth to comb-like teeth during the growth of the fish. This is one of the outstanding features of this peculiar dentition; extensive investigations have hitherto been performed from the viewpoints of morphology and ecology. However, no detailed description concerning the early development of such a remarkable dentition was presented in the previous literature. Hence the author wishes to try to clarify the subject. The materials used were 13 young marine species from Wakasa Bay in the spring of 1955, measuring 35.7-67.0 mm. in body length; 5 land-locked specimens from Lake Biwa in the summer of 1954, measuring 55.0–108.0 mm. in body length. It is interesting to notice that the first primordia of comb-like teeth are recognized in 35.5 mm. young specimens which live in the sea (or in the lake for the land-locked form). At this stage both conical and comb-like teeth develop simultaneously. The primordia lie externally to, and separated from, the dentary and maxillary, while conical jaw teeth originate near the dorsal or ventral border of these bones. No clear difference in developmental phase is distinguishable between the sea run form and the land-locked one.

KAWAJIRI, MINORU, 1956: The "Ugui", *Tribolodon hakueneis* in the Chikuma River, Nagano Prefecture with Reference to the "Tsukeba" Fishery, Biology and Conservation. Bull. Fresh. Fish. Lab., 5 (2), pp. 1–41. (in Japanese).

The writer describes the ecological studies of *Tribolodon hakuensis* in the River Chikuma, Nagano Prefecture. He also describes a peculiar way of fishing the fish, carried out now in the river.

KOBAYASHI, HISAO, 1956: Fishes of Atsumi Bay: Mikawa Shizen Kôen Chôsa Hôkokusho*, pp. 62–77. (in Japanese).

The writer mentions 324 species from Atsumi Bay. Among these species, only 7 freshwater fishes are found as followings.

1. *Eptatretus burgeri*
2. *Plecoglossus altivelis*
3. *Salangichtys microdon*
4. *Anguilla japonica*
5. *Mugil cephalus*
6. *Lateolabrax japonicus*
7. *Therapon oxyrhynx*

KOBAYASHI, HISAO, 1956: Phylogenetical Consideration of Japanese Cobitid Fishes by the Study of Scale Character (II). Bull. Aichi Gakugei Univ, vol. 5, pp, 24–28. (in Japanese).

The writer continues his study on the scale of the Cobitid fishes and describes the result in this report.

KOBAYASHI, HISAO, 1956: Scale Character of the Intergeneric Hybrid between *Cobitis taenia* LINN. (♀) and *Misgurnus fossillis anguillicaudatus* (CANTOR) (♂). Ann. Zool. Jap., 29 (2), pp. 104–108.

The author makes an experiment of intergeneric hybrid between *Cobitis taenia* (♀) and *Misgurnus fossillis anguillicaudatus* (♂). The material of *Migurnus* attains 7.4 cm in body length and *Cobitis* somewhat larger, measured 7.8 cm. The former specimens were collected at Okazaki Fish Market, Aichi

* Mikawa Shizen Kôen Chôsa Hôkokusho = Report of the Mikawa Natural Park published by the Aichi Prefecture Government.

Prefecture. The latter specimens were caught in the River Sakai near Togomura, Aichi Prefecture. He mentions that the intermediacy of scale characters of the hybrids is pointed out. Four scale characters of the hybrids (scale length, scale breadth, relative focal area, and length of radial grooves are virtually intermediate between those of the parental species. With respect to the number of circular grooves, the hybrid closely approaches *Cobitis*. It may be recommended for us to use scale characters as a means of identification of intergenetic hybrids, because such characters are clearly defined between different genera.

MATSUI, YOSHIICHI. MAKINO, SAJIRÔ and OJIMA, YOSHIO, 1956: Some Cytological Observations on Male Sterility in the Carp-Funa Hybrids. J. J. I., 5 (1), pp. 52–58. (in Japanese).

The writers mentioned on some cytological observations on male sterility in the hybrids between carp and crucian carp. They also succeeded in the reciprocal crosses. The hybrids grow regularly with no anomalies in their developmental course. They rank intermediate between the parent species in several characters. The hybrid male are completely sterile. Their testes generally lack spermatogenetic activity. The chromosomes are 99 in numbers, being the total sum of the haploid numbers of the parents, 52 for carp and 47 for crucian carp. Meiosis in the hybrid testes in highly disturbed, being arrested at early stages of the meiotic prophase. Most of germ cells undergo pyonotic degeneration during the period from late leptotene to pachytene, and no spermatozoa are produced. In some hybrid specimens, the gonads show mosaic structures composed of testicular and ovarian elements, an evidence suggesting that sterility is associated with intersexuality, caused by the genetic unbalance between the parents.

MINAMORI, SUMIO, 1956: Physiological Isolation in Loaches. "Syudan Idengaku", pp. 163–167. (in Japanese).

The writer reports on the population of loaches differing each other to the thermic adaptation. The strength of isolation between two populations is parallel to the degree of difference in thermic adaptation between them. The isolating mechanisms among the populations of loaches seem to have arisen as a by-product of the adaptation to different thermic environments. The hybrid incapacitation in the loaches seems to have been established after the ecological barriers to cross arose.

MORI, TAMEZÔ, 1956: Fishes of Sanin District including Oki Islands and its Adjacent Waters (Southern Japan Sea). Mem. Hyogo Univ. Agric*., vol. 2. no. 3, Biol. Ser. No. 2, pp. 1-62.

Since 1952, the author has studied the fish fauna of this district and its adjacent waters of the Southern Japan Sea, as the result of which 542 species are shown in this paper. Of them 59 species (consisting of 16 northern forms, 8 southern forms and 35 intermediate forms) are freswater fishes. In the account of the freshwater fishes, most of 39 species of pure freshwater fishes are the temperate zone fishes. Anadromous fishes and land-locked fishes of Salmonidae are the arctic ones, belonging to northern forms with a close affinity with those in the Japan Sea.

NAKAMURA, KAZUO. SHIMADATE, MAGOI. ÔKUBO, HIDEJI. KOYAMA, HAJIME. MIYAJIMA, TORU. ITO, TOKIO and TOI, JUNICHI, 1956: Possibility of Carp Fingerling Production in Farm-Pond, Nagano Prefecture. Bull. Fresh. Fish. Lab., 6 (2) pp. 1–49. (in Japanese).

The culture of carp fingerling, a farm pond, has been practised in some districts of Honshû, Japan. The writers made a preliminary experiment in 1953 and report in the present paper on the hydrology of pond water, natural food of fish, its breeding habit, movement of the fish in the pond in order to get the scientific background for the interpretation of the result of experiment.

OGURA, CHITARU, 1956: Some Observations on the Effect of Estrogen upon the Liver of the Three-spined Stickleback, *Gasterosteus aculeatus aculeatus* L. Ann. Zool. Jap., 29 (1), pp. 19–22.

* Mem. Hyôgo Univ. Agric. = Memoires of the Hyôgo University of Agriculture, Tanba, Kyôto-fu.

The writer makes an experiment on the estrogen which brought about certain changes in weight, structure and fat content of the liver of *Gasterosteus aculeatus aculeatus*. The result is as follows. In the normal liver of *G. aculeatus aculeatus*, sexual differences were recognizable in weight and in morphological characters. The liver of the male fish injected with estradiol benzonate was transformed to an organ resembling that of the female, showing the reduction in weight, cell size and fat content, together with morphological changes in the mitochondria.

OKADA, YAICHIRÔ and KUBOTA, SABUROH S., 1956: Studies on the Fish Fauna at the Southern Vicinity of Tsu City, Mie Prefecture. Rep. Fac. Fish. Pref. Univ. Mie*, 2 (2), pp. 205-216.

The author made an intensive collection of brackish freshwater fishes at the River Aikawa, a small stream flowing into Ise Bay around Tsu City, Mie Prefecture, Japan. The collections were made from February to December. In the specimens are included 27 families, 48 genera, and 56 species, and the main factores affecting the distribution are tidal movements, partitive dums, and ways of water supply or drainage. The recent fauna is freshwaters which include irrigation ditches, rice fields, irrigation water way and others, is changing under the influences of conservancy or agricultural chemicals snch as disinfectant, insecticide and artificial fertiliger.

ÔSHIMA, MASAMITSU, 1956: Effects of the Electric Dam erected in the Down Stream of the Kuma River in the Year 1954, upon the Development of "Ayu" *Plecoglossus altivelis*. J. J. I., 5 (1-2), pp. 1-11. (in Japanese).

Recentiy in the utilization of the river for the sake of generation of electricity, many dams are established in Japan, and the fishermen are very much afraid of the shutting up completely the passway of the andromous fishes. The writers observed the present condition of the Kuma River of the Kumamoto Prefecture during several years in order to solve the difficult problems. In the present paper, he also mentiond the morphological differences between sea-run form of "Ayu" grown at the both sides of the dam; effect of suitable baits upon development of land-locked dwarf form of "Ayu' originated in Lake Ikeda, Kagoshima Prefecture; distinction between sea-run form and land-locked form of "Ayu" after fattering, from the observations of scale figurations.

ÔSHIMA, MASAMITSU, 1956: Studies on the Dimorphic Salmons, *Oncorhynchus masou* (BREVOORT) and *Oncorhynchus rhodurus* JORDAN et McGREGOR, found in Japan and Adjacent Territories. pp. 1-79. Nireshôdo, Sapporo, Hokkaidô. (in Japanese).

This is a small book about *On. masou* and *O. rhodurus* published by the present authors. He is spending nearly half of his life for the study of the trout in Japan. He describes the classification and ecology of the two species of the trout. He also mentions the cross breeding of *O. masou* and *O. macrostomus*.

SATÔ, MITSUO, 1956: Studies on the Pit Organs of Fishes. IV. The Distribution Histological Structure and Development of the Small Pit Organs. Ann. Zool. Jap., 29 (4), pp. 207-212.

Concerning this small pit organ, there are very few studies and the accurate distribution and the development of this organ have not been investigated until today. The author tries in the development of the small pit organs of Japanese catfish.

SATÔ, MITSUO and YAMAZAKI, GORÔ, 1956: Embryonic Development of the Catfish, *Parasilurus asotus* L. Zool. Mag., vol. 65, no. 9, pp. 325-328. (in Japanese).

The writers study the breeding habits and gross development of *Parasilurus asotus*. In Hirosaki, Aomori Prefecture, Honshû in Japan, the breeding season is extending from the beginning of Jun to

* Rep. Fac. Fish. Pref. Univ. Mie=Report of the Faculty of Fisheries Prefecture University of Mie published by the Faculty of Fisheries, Prefectural University of Mie, Tsu, Mie Prefecture.

the end. In this season, males and females migrate at night in a group from the streams into the rice fields to spawn. The eggs are spherical, measuring 1.5 mm in diameter, with a jelly-like coating. Hatching occurred in about 57 hours at the water temperature 23°C. The larva just hatching out measured 4 mm long.

SHIRAISHI, YOSHIKAZU. BABA, YOSHINOBU and others, 1956: Biological Studies of "Koayu" (deformed *Plecoglossus altivelis*) in Lake Saiko, Yamanashi Prefecture. Rep. Fresh Fish. Lab., pp. 1-34. (in Japanese).

The writers make a research of "Koayu" in Lake Saiko, Yamanashi Prefecture. In this report they report the results of the researches on reproduction, spawning habits, food habits and migration in the lake.

SUZUKI, RYÔ, 1956: A Study on the Interfamiliar Crossing between Minnow (*Gnathopogon elongatus elongatus*) and Mud loach (*Misgurnus anguillicaudatus*). Bull. Aichi Gakugei Univ., vol. 4, pp. 29-34.

In the previous paper the writer reported successfully in the reciprocal crossing between mud loach and gold-fish, which are of different families on anothor and he concluded that the hatching larvae were interfamiliar hybrids, since he recognized the effect of the paternal genes as well as maternal ones. In the present paper he reports the results of the reciprocal crossing between minnow (*G. elongatus elongatus*) and mud loach (*M. anguillicaudatus*). These fishes are belonging to different families.

SUZUKI, YOSHITAKE, 1956: A Histological Study of the Grandular Processes on the Lips of Scythe Fish *Pseudogobio esocinus* (T. et SGH.). J. J. I., 5 (1-2), pp. 12-14. (inJapanese.)

The writer made the histological Studies on the grandular processes on the lips of scythe fish which is a bottom-feeder with a broad queer lips, collected at Okazaki City, Aichi Prefecture on August of 1952. On the lips are found many granular processes in which numerous taste buds can be observed. They are distributed mainly about the apex of each process in numerous numbers and gradually less towards the ventral side. The shape and structure are nearly similar to those of barbels. It may be inferred that the granular processes on the lips play an important role when finding food.

TATEISHI, SHINKICHI, 1956: On the Lot of Unspawned Eggs of *Cyprinus auratus* LINN. Bull. Fac. Fish., Nagasaki Univ*. no. 4, pp. 1-5.

The writer describes the fate of the unspawned eggs of *Cyprinus auratus* in this paper. This fish contains numerous unspawning eggs after spawning, some of them are reserved for the next spawning time in the same year while the others are never to be spawned in any spawning season of the same year. They gradually follow the course to final disintegration or absorption, and what participates in this process is the surrounding tissue of the ineffective spawn, follicle cells in particular. The follicle cells in this case can nearly be discriminated from the empty follicle cells which is found immediately after spawning. These two kinds of follicle cells can be seen in the ovary after the spawning season, and both of them are gradually disintegrated or absorbed and disappear. Thus the degree of the degeneration enables us to trace out the date of their spawning. He discovers corpus luteum in the post spawning ovarian tissue presumably formed by the cells around the oocytes, those being left ineffective after it had developed enough to be called a ripe spawn.

TATEISHI, SHINKICHI and YAMASHITA, HIDEO, 1956: A Histophysiological Study on the Adaptability of *Oryzias latipes* to Salt Water (Preliminary Note). Zool. Mag., 65 (5), pp. 194-197. (in Japanese with English summary).

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* Bull. Fac. Fish. Nagasaki Univ. = Bulletin of the Faculty of Fisheries of Nagasaki University, Nagasaki, Kyûshû.

The writer makes an experiment on the resistance of *Oryzias latipes* against salt water histophysiologically. He concludes that the adaptability of this fish to salt water is closely connected with the existence of the so-called chloride cells.

YAMAMOTO, KIICHIRÔ, 1956: Studies on the Formation of Fish Eggs. VIII. The Fate of the Yolk Vesicle in the Oocyte of the Smelt, *Hypomesus japonicus*, during Vitellogenesis. Embryologia*, 3 (2), pp. 131-138.

In the present paper, the writer describes the three kinds of vitelline particles in the oocytes of the smelt, namely yolk vesicles, yolk globules and fatty droplets. Of these particles the yolk vesicles seem to be quite different from others both in origin and function. The vesicles which may be derived from argentophilic bodies are formed as the first vitelline particles and develop subsequently into the cortical alveoli. The predominant of compoments of the vesicles consist of polysaccharides. In the course of vitellogenesis the polysaccharide substances in the vesicles change from ventral mucopolysaccharides into mucoids associated with acid mucopolysaccharides.

YANAI, TAKAICHI, UJI, MASAMI and IGA, TETSURÔ, 1956: Development of the Hatching Glands in the Teleost, *Hypomesus olidus* (PALLAS). Ann. Zool. Jap., 29 (4), pp. 202-206.

The author also has found that in *Hypomesus olidus*, the mother cells of the hatching glands again arise as patches of ectodermal cells in similar sites of the body, but the mode of dispersion of the cells during embryonic development and consequently, the final distribution of the glands on the body surface embryos at hatching are different from those in the two foregoing species. ISHIDA is the only author who has, if briefly, described the distribution of the hatching glands in the adult of *Hyomesus olidus* and no one has studied the developmnet of the glands in this species.

1957

EGAMI, NOBUO, 1957: Inhibitory Effect of Thiourea on the Development of Male Characteristics in Females of the Fish, *Oryzias latipes*, kept in Water containing Testosterone Propionate. Ann. Zool. Jap., 30 (1), pp. 26-30.

The papillary processes on the anal fin rays presented only in adult males *Oryzias latipes*, are produced in females, if they are kept in water containing androgens. The author wishes to clear the effect of thiourea on the development of fin-processes in female fish, placed in testosterone propionate containing water. From his experiment, he concludes that thiourea exerts an inhibiting effect on the formation of processes in androgen-treated females of *Oryzias* by reducing the secretion of hormones from the thyroid gland, by interfering with the general health.

HAMADA, KEIKICHI, 1957: Revision of *Hypomesus olidus* (PALLAS) and *Hypomesus japonicus* (BREVOORT) of Hokkaidô, Japan. Bull. Fac. Fish. Hokkaidô Univ., vol. 4, no. 4, pp. 256-267.

The author confirms the difference between *Hypomesus japonicus* and *Hy. olidus*, although some previous investigtors confused both of them. He pointed out that the differences between two species are the size of scales, the number of vertebrae and the position of pelvic insertion.

IMAI, SADAHIKO and NAKAHARA, KANTARÔ, 1957: Life History of *Coreoperca kawamebari* (T. et SCH.), Suisangaku Syusei*, pp. 591-601. (in Japanese).

The author describes the features and local variations of *Serranus kawamebari* TEMMINCK et SCHLEGEL distributed in Shikoku, Kyûshû and the south-western part of Honshû. He makes an observation

* Embryologia = "Embryologia" published by the Zoological Institute, Faculty of Science, Nagoya University, Nagoya.

** Suisangaku Syûsei=Suisangaku Syûsei edited by Prof. H. SUEHIRO, Y. HIYAMA and Y. OSHIMA for the memorial monograph for Prof. I. AMEMIYA. Tôkyô Daigaku Shuppankai, Tôkyô.

of this fish in the northern Kyûshû during 1934–46. He notes an interesting subject on habits and environment and life history. This fish attains 130 mm. in body length. It lives in the clear water of middle and upper rivers, and hides in shadow and solitary. It likes fighting and takes small animals. The breeding season occcurs during May and June. The optimum temp-erature is ranged commonly from 18°C to 25°C. During the breeding season, female and male make a group and the female deposits eggs on the stem of water plants. The female measured about 80 mm. deposits 700 eggs. The male guards the eggs and larva until they grow to post embryo. The eggs measured 2.2–2.4 mm. in diameter, are dermersal adhesive. Many oil globules are found in an egg, the maximum one measured 0.35 mm. in diameter. The embryo hatches out in 8–10 days at the water temperature of 20–25°C.

IMAMURA, TAIJI and HASHITANI, SHÔSHI, 1957: On the Food Habits of Four Fishes in March Hinuma. Bull. Fac. Lit. Arts. Ibaraki Univ*., Nat. Sci., no. 7, pp. 45–56. (in Japanese).

The writers investigates in the natural food of *Acanthogobius flavimanus*, *Therapon jarbua*, *Tribolodon hakuensis* and *Oryzias latipes* in Marsh Hinuma around Mito City of Ibaraki Prefecture. The three former species mostly feed on the small crustaceans *Neomysis intermedia* aud often on *Neries* and *Copepods*. The last species *Oryzias latipes* mostly feed on pelagic small crustaceans, *Copepods* and *Mysis*.

ISHIDA, JURÔ and TAGUCHI, SHIGETOSHI, 1957: Effect of 2.4 = Dinitrophenol and Sodium Azide on Lactic Acid Production during Early Development of the Teleost, *Orizias latipes*. Ann. Zool. Jap., 30 (1), pp. 1–7. (in Japanese).

The author studies the effect of DNP and sodium azide, administered singly or in combination, on the production of lactic acid in early embryos of *Oryzias latipes*. He concludes that the embryonic development was reversibly iuhibited by 1.11×10^{-4} M DNP. Exposure to higher concentrations of DNP produced irreversible inhibition. If embryos were exposed to 1.11×10^{-4} M DNP, lactic DNP or sodium acid was produced several times more than in controls. When embryos were immersed in DNP or sodium azide at the concentration of 10^{-4} M for 20 hours, lactic acid produced by the embryos was accumulated within embryonic bodies, without diffusing to the outside media. The concentrations of 10^{-2} and 10^{-3} M of azide for 1 hour was much less effective than that for 20 hours. DNP plus sodium azide which exerted an additive effect on the accumulation of lactic acid within embryos, i. e., increase in the production of lactic acid due to DNP angurented by sodium azide.

KAFUKU, TAKEICHIRÔ. YONEZAWA, KUNIO and YOSHIZAKI, KATA, 1957: The Spawning Conditions of "Koayu"in Lake Motosuko Fresh Fish. Lab., Kenkyû Shiryô No. 8, pp. 1–17. (in Japanese).

In 1952, the authors investigated the spawning ground at Motosuko (one of the lakes around Mt. Fuji), Nagano Prefecture. They described the natural condition of Lake Motosuko, the spawning season of the *Plecoglossus altivelis*, the number of eggs and body length of the adult female, the size of pebbles found in the spawning ground and the distribution of the pebbles along the coasts of the lake, the slope of coasts of the spawning grounds, the depth of the ground, durnal movements of the adults for spawning. They concluded that in the case of Lake Motosuko as one of the mouthless lakes without rivers around it, the wind power greatly influenced the location of the spawning ground.

KAWANABE, HIROYA. MORI, SYUITI and MIZUNO, NOBUHIKO, 1957: Modes of Utilizing the River-Pools by a Salmon-like Fish, *Plecoglossus* or "Ayu", in Relation to its Population Density. Jap. J. Ecol., vol. 7, no. 1, pp. 22–26. (in Japanese with English summary).

They report the changes of the modes of utilizing the river-pools; two kinds in the life of "Ayu" in pools. They are related to the topographical characteristics of the river-pools as well as to their

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* Bull. Fac. Lib. Arts. Ibaraki Univ. = Bulletin of the Faculty of Literature and Arts, Ibaraki University, Utsunomiya, Ibaraki Prefecture.

adjoining riffles, namely, using the pools as both feeding and resting places or shelters only. They also discovered that the modes practically taken by "Ayu" might change according to the population density.

KUBOTA, ZENZIRÔ. MATSUI, ISAO. SHIRABANE, GENZI and YOSHITAKE, YOSHIO, 1957: Studies ou the Reproduction of the Loach, *Misgurnus anguillicaudatus* (CANTOR) I. Influence upon the Productivity due to the Size of Fry. Journ. Shimonoseki Coll. Fish., vol. 7, no. 1, pp. 121–127.

The authors made two experiments on the loach concerned to the influence of the size of the fry on the productivity, and to the influence of variant degrees on the productivity. They concluded that the weight multiplication rate was higher in large-sized ones. The food coefficient is smaller in younger fish than in older ones. The variant degrees in the size of the fish have no influence on the productivity.

USA, MAMORU, 1957: Osmotic Behavior of the Isolated Cortical Alveoli of Stickleback Eggs. Ann. Zool. Jap., 30 (2), pp. 67–70.

The author makes a research on osmotic properties of the cortical alveoli isolated from the unfertilized eggs of the stickleback, *Pungitius pungitius*. After he makes many experiments on this problem, he concludes that the envelopes of the cortical alveoli in the unfertilized eggs of *Pungitius pungitius*, work as osmotic membranes permeable not only to water but also to several substances, such as urea, ethylene glycol, ghycerin and various basic dyes, as well based on these findings, it is inferred that the envelope is not a simple homogeneous lipoid layer, but a covering having some specialized areas or areas thereon to permit the penetration of either water or certain lipoid insoluble substances.

MATSUI, ISAO, 1956: The Number of Eggs discharged at its Primary Spawning in Relation to the Number of Ovarian Eggs in Carp. Jour. Shimonoseki Coll. Fish., vol. 7, no. 1, pp. 147–150. (in Japanese).

The author reports the number of eggs found in ovary of carp, namely, 190,000–700,000, is reduced to 15.4–51.9% by discharging 50,000–620,000 eggs at its first spawning. The number of the eggs of the first discharge (P) stands in such relation to the body weight (W) as given by the formula (1).

$$P = \frac{651{,}800}{1 + e^{3{,}500 - 0{,}953W}} \qquad (1)$$

The formula (2) describes the relation between the number of the ovarian eggs (0) and the body weight

$$0 = 735{,}300 \, \{1 - 0.732^{-0 \cdot 374(W-1)}\} \cdots\cdots\cdots\cdots (2)$$

These formulae suggest that a female at least over 4 kg in weight should be employed for sucessfully carrying artificial insemination.

MATSUI, ISAO, 1957: On the Records of a *Leptocephalus* and Catadromous Eels of *Anguilla japonica* in the Waters around Japan with a Presumption of their Spawning Places. Jour. Shimonoseki Coll. Fish., vol. 7, no. 1, pp. 151–167. (in Japanese).

The author has studied the life history of *Anguilla japonica* since 1952. He obtained a *Leptocephalus* around Japan at a spot off about 270 miles west of the Amami Ôshima during the end of May to that of June. He supposes the spawning time of the eel begins early in spring and continues until early in summer. He also considers that the favorable spawning ground is about 4,000 meters deep where the water temperature is about 15°C during the period between February and June as in the Pacific Ocean.

MIZUNO, NOBUHIKO and KAWANABE, HIROYA, 1957: Behavior of Salmon-like Fish "Ayu" in an Area with closely established Territories. Jap. Ecol., vol. 7, no. 1, pp. 26–30. (in Japanese with English summary).

The authors observed that a number of territories of "Ayu" covered the stone-bottom near Ukawa Bridge at the lower part of the River Ukawa in Kyôto. In this area, the fish in the territories hardly go out of their respective home range, that they do not extend their home ranges immediately after the departure of their adjoining individuals from their territory. That territory has A and B individuals. The fish in territories spend so much time in driving out their invaders that they have no plentiful time to secure their food.

NIWA, HISASHI, 1957: Eels of the River Kayukawa. Nagaragawa no Seibutsu*, pp. 216-218. (in Japanese).

The author describes a peculiar phenomena in which the eels are living in the River Kayukawa, Gifu Prefecture very abundantly. This location is now preserved by the national monuments. He added a list of the fishes found in the river and studied by Mr. NEKOYAMA, TSUNEZO, *Anguilla japonica, Oncorhynchus milktschitsch macrostomus, O. milk. rhodurus, Plecoglossus altivelis, Pelteobagrus nudiceps, Liobagaus reini, Pseudogobio esocinus, Sarcocheilichthys variegatus, Leuciscus hakonensis, Phoxinus steidachneri, Zacco platypus, Z. temminckii, Carassius carassius, Cyprinus carpio, Misgurnus anguillicaudatus, Cobitis biwae, Cobitis delicata, Cottus pollux, Cottus kazika, Rhinogobius similis, Tridentiger obscurus.*

NIWA, HISASHI, 1957: Fishes of the River Nagaragawa. Nagaragawa no Seibutsu, pp. 190-216. (in Japanese).

The author made a survey of the fishes distributed in the River Nagaragawa during 1956 and 1957. He listed up 66 species of the freshwater fishes from this river.

OKADA, YAICHIRÔ end KUBOTA, SABUROH S., 1957: Description of a New Freshwater Catfish, *Coreobagrus ichikawai*, with an Emendation of the Genus *Coreogrus* MORI. J. J. I., vol. 5, nos. 4-6, pp. 143-145. (in Japanese with English summary).

The writers obtained specimens which may be of new species *Coreobagrus ichikawai*, from the River Isuzu at Koraibiro, Ise City and the River Miyagawa at Ôsugidani village, Taki District, Mie Prefecture, Japan. This species is closely allied to *C. brevicorpus* from Korea by MORI (1936) but distinguished from it by its slightly longer body, smaller eye and incompletely biforked caudal fin.

OKADA, YAICHIRÔ and MORI, KÔICHIRÔ, 1957: Ecological Study of *Salangichtys microdon* in Breeding Season. J. J. I., vol. 5, nos. 4-6, pp. 99-106. (in Japanese with English summary).

The writers report the results of the ecological study of *Salangichthys microdon* in the breeding season at the mouth of the River Nagaragawa, Akasuka, Kuwana City, Mie Prefecture. The results are as follows. The fishes in the breeding season are composed of one age group and a remarkable change of their composition of both sexes was not predicted. It is estimated from their data that the change of the composition is roughly parallel to that of body length, and the flourising spawning season extends from about the middle of March to the first part of May.

ÔSHIMA, MASAMITSU, 1957: Notes on the Fishes Collected in the Down Stream of the Tama River, with Descriptions of two New Species. J. J. I., vol. 6, pp. 14-19. (in Japanese with English summary).

The author reports on the fishes obtained in the down stream of the Tama River around Tôkyô by the courtesy of Mr. KUNIHIKO SHIRAI. In this report he makes a new description of freshwater fishes which were named *Pungtungia shirai* n. sp. ("Shirai-mugitsuku") and *Biwia* n. sp. "(Tamabaya)".

ÔSHIMA, MASAMITSU, 1957: List of the Freshwater Fishes obtained in the South-eastern Kyûshû. Jap. J. I., vol. 6, pp. 9-13. (in Japanese with English summary).

* Nagaragawa no Seibutsu = Biology of the River Nagara published by the Gifu Prefectural Government.

The author gives a list of freshwater fishes obtained in the South-eastern Kyûshû, collected during the summer of the year 1954–55. Thirty-five species are shown in the list.

SHIRAISHI, YOSHIKAZU and SUZUKI, NORIO, 1957: Freshwater Fisheries Studies on *Oncorhynchus rhodurus* (JORDAN et McGREGOR) found in the River Manogawa, Mie Prefecture. I. Morphological Studies on the outer feature. Fresh. Fish. Lab., Kenkyû Shiryô No. 9, pp. 1–18. (in Japanese).

The writers investigated *Oncorhynchus rhodurus* from the biological point of view. The topics pointed out in their report are the growth, the relation between the body length and body weight, the relative growth, secondary sexual character, sex ratio, and red spots on the belly. They mention the relative growth of head length, body height and body breadth. For the account of the secondary sexual character, the relation of body length and head length and nuptial color of the fins are described. The sex ratio does not change till April of the lst year but after that the ratio changes into the male 26: female 14 till December. The female may descend into the sea in the spring of the second year. The rate of gonad ripened corpulense is the maximum in autumn while the rate of body corpulense is the maximum in summer and minimum in winter. 7–19 parrmarkes are distributed and the red spots on the belly are increasing gradually by the growth of body length. No diffenece between female and male is found.

SHIRAISHI, YOSHIKAZU. SUZUKI, KISABURO and TAMADA, GORO, 1957: Freshwater Fisheies Studies on *Oncorhynchus rhodurus* (JORDAN et McGREGOR) found in the River Manogawa, Mie Prefecture. 2. Spawning Habits. Fresh. Fish. Lab., Kenkyû Shiryô No. 14, pp. 1–17. (in Japanese).

This is the second report of the investigations on *Oncorhynchus rhodurus* in the River Manogawa. They describe the spawning habits, spawning season, movements of the adult for spawning, environment of spawning grounds, the number of eggs attached to substratum and the fate of the remained eggs in her body.

SHIRAISHI, YOSHIKAZU and TAKEYA, TSUKIE, 1957: Bibliography of the Study of "Ayu" fish, *Plecoglossus altivelis* for the Years 1882–1955. Fresh Fish. Lab., Kenkyû Shiryô No. 13, pp. 1–102. (in Japanese).

The writers listed up many literatures of "Ayu" fish for the years 1882–1955 for the convenience of researchers.

SUZUKI, NAOKICHI, 1957: Notes on the BELLONCI's Nucleus o f*Salvelinus malma*. Suisangaku Syûsei, pp. 757–762. (in Japanese).

The author finds out the BELLONCI's Nucleus in a brain of *Salvelinus malma*. On the nucleus commissurae hippocampi, there is some group of cells called BELLONCI Nucleus. This cell is quite distin guishable from nucleus habennulae. In the section of BELLONCI Nucleus, it is found spreading between the ependymal layer and fasciculus retroflexus of the brain. In this case, nucleus commissure hippocampi is decreasing in size.

SUZUKI, RYO, 1957: Studies on the Artificial Ovulation in Cyprinid Fishes I. Artificial Ovulation in the Minnow, River-chub, Gold-fish and Crucian Carp. Bull. Aichi Gakugei Univ. vol. 6, pp. 31–35. (in Japanese).

The ovulation of teleost fishes accelerated by the injection of hormones from anterior pituitary bodies of certain animals. The author makes the experiments for the artificial ovulation of the minnow, river-chub, gold-fish and crucian carp. He reports that 60–87% of the Cyprinid fishes injected with the hormone from the anterior pituitary body of the loach is effective.

SUZUKI, RYÔ, 1957: Hybridization Experiments in Cobitid Fishes. J. J. G., 32 (1), pp. 8–14.

The writer makes a reciprocal crossing made among the three species; *Cobitis biwae*, *Lefua echigonia* and *Misgurnus anguillicaudatus*. From his experiments, he concludes that *C. biwae* and *M. anguillicaudatus* are closely related, that *M. anguillicaudatus* and *L. echigonia* are less closely related than the above, and that *C. biwae* and *L. echigonia* are taxonomically furthest apart.

SUZUKI, RYÔ, 1957: Development of Gold-fish Eggs Inseminated with some Foreign Sperms. (Preliminary Report). Zool. Mag., 66 (1), pp. 34–37. (in Japanese with English summary).

The writer tries the cross experiments on the relation between gold-fish and other foreign sperms and reports the results in this paper. In the interfamiliar and intergeneric cross bred eggs the initial cleavage seemed to be identical with that of pure bred ones. Most of them died during earlier embryonic life, with a few deformed larvae which died within one to 25 days after hatching. The crossed eggs between *Carassius auratus* ♀ and *Cyprinus carpio* ♂ developed normally. In the cross bred eggs was found a gradient of the developmental vigor, and the order of this gradient does not coincide with that from the taxonomical point of view, which insists that the relation between gold-fish and *Misgurnus anguillicaudatus* or *Cobitis biwae* is far more apart from that between gold-fish and *Zacco platypus* or *Zacco temminki*.

TAKAGI, KAZUMORI, 1957: Descriptions of Some new Gobioid Fishes of Japan, with a Proposition on the Sensory Line System as a Taxonomic Character. Jour. Tôkyô Univer, Fish., vol. 43, no. 1, pp. 97–126.

The author describes the gobioid fishes found in South Japan. Six species of one new genus *Paleatogobius* were found to be new to science. Of these, two freshwater ones *Pal. uchidai* and *Chaenogobius scrobiculatus* are mentioned in this report.

TANAKA, KOJIRÔ, 1957: An Experimental Study upon the Artificial Collecting Young Fishes of *Cobitis* (*Misgurnus anguillicaudatus*). Suisangaku Syûsei, pp. 81–127. (in Japanese).

The author has carried it out experimentally in the method of artificial collecting of young fishes of loach. The dosage of pituitary hormone of *Rana catesbeiana* SHAW is about 0.9 mg. for a adult loach, which is effective and economical. Besides, the injection of the mixture of 375 MU "Bontomi F" and 0.12 mg. of pituitary body of *Rana catesbeiana* SHAW can also produce the ovulation of loach. The effect can be obtained through injecting once a day or two times in two days successively from the end of May to the middle of July. Pupa of silkwarm, artificial food for fishculture is not taken directly by loaches as their food, but it is useful indirectly and especially in the presence of the soil the degree of its utilization is remarkably high and the value of food coefficient is 1.6 under the condition. According to the result of the experimental study noted above, it is clear that the artificial collecting of fry of loaches is possible. Then he describes the most neccessary matter in the method to enforce the artificial collecting. In accordance with the result of the experimental study, he will show the outline of the standard force of the artificial collecting of young fishes of loaches. Although it is obvious in this experiment that the artificial hatching of loaches and subsequent breeding of the young fishes are possible in the resting state water of pools, it is desirable that the water of pools would be kept in a streaming state, because the change of the quantity of water influences very much the growth of the young loaches hatched artificially. The optimum temperature of hatching of loaches is 24–25°C. The application of the mixture of pituitary hormone of "*Rana catesbeiana* SHAW" and "Bontonin F", brings a remarkable effect on the ovulation of loaches. The fry immediately after hatching begin to taken food; chicken eggs are taken as well as planktons such as *Rotatoria* and Chlorophyceae. The hatched fry are bred for 8 days then they are bred for 12 days in an earthenware water tank for breeding. Moreover, they are bred for 32 days in a pool with an area of 32 m^2 whose bottom has been also covered with the soil of rice-fields. Young loaches grow up to a proper size in no less than 52 days after hatching. The range of changes of the value of pH is between 6.0–7.8 and the ranges of the water temperature 25.0–32.0°C during this study.

From the conditions mentioned above, he can advocate that artificial collecting of young loaches traces probably the same process as that of carp, and that it can become a steady enterprise.

YOSHIZAKI, MASA, 1957: Morphological Change of Intestine in the Larval Stage of Wild Gold-fish (*Carassius auratus*) 1. Observation on Variety "*Gengorobuna*'. J. J. I., vol. 5, nos. 4-6, pp. 78-83. (in Japanese with English summary).

The writer studies the morphological change or coiling of "*Gengorobuna*", a variety of *Carassius auratus*. He observed 122 individuals, youngs and adults. In the fish 70-80 days after hatching, C type of coiling* of the organ is formulated. The developmental change of intestine apparently shows the characteristic feature of the organ which has passed over the four-established forms *Cyprinus carpio* "*Kinbuna*" a variety of *C. auratus*, "*Ginbuna*" a variety of *C. auratus*, "*Gengorobuna*" a variety of *C. auratus*.

3. Fisheries and fishing gears

a. Historical development of freshwater fisheries and gears in Japan

Pre-historic Age: During this age, the fisheries was carried out in the sea and freshwater. By the excurvation of shell mound, many kinds of bones belonging to carp, dace, eel and trout together with those of marine fishes were discovered. From the consideration of the research for the pre-historic fisheries, the most primitive fishing method is called "Kaibori" which was used for catching fishes easily by hands and browing bow arrow, in ponds and swamps, drowing the water away and dry them. The harpoons (pl. X, 1; fig. 1, 2) were seemingly used in general and lines with hooks ma-

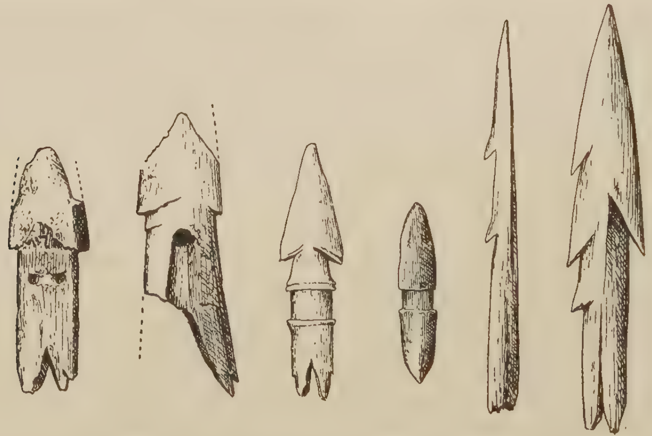


Fig. 1. Harpoons found in a shell-mound at Abashiri, Hokkaidô. These harpoons were used by "Moyoro" people who lived in this district during about 8000 years ago.

de of antler of deer. Probably net fishing was already used in this age. In the sufficient evidence of the net patterns pressed on the earthenware which were discovered in

* Kafuku, T. 1932

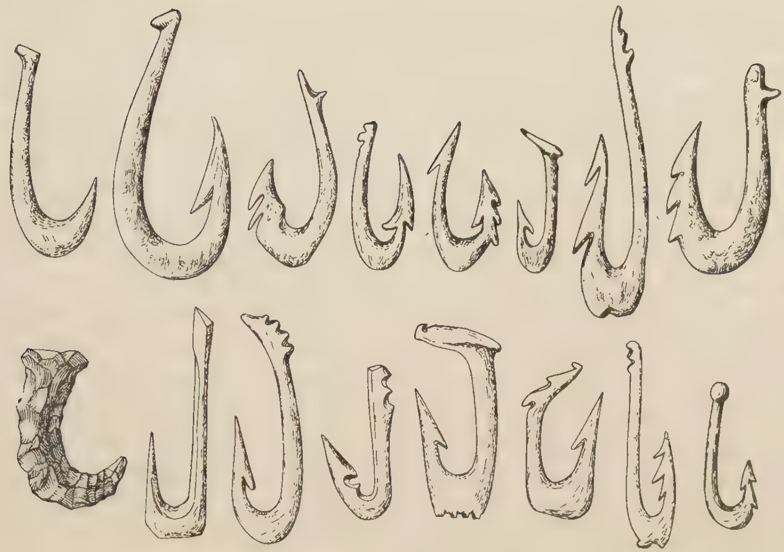


Fig. 2. Simple fish hooks from prehistoric Japan (upper line) and Europe (lower line).

shell mounds, the author guessed the very primitive Lift nets ("Tamo Ami", "Sade Ami") and also the Touring nets by food were used in lakes and rivers. Further more, the crude making pots or traps with bamboo or wood branches which were used for fishing. Anyhow, in the pre-historic age, we had no iron materials, so that the plant fibers was mostly used for nets.

Ancient age: In B. C. 667, when JIMMU Emperor subjugated the eastern part of Honshû, Japan, one of the fighter called "SHIINETSUHIKO" made fishing by fish pot or trap at Ata, Yamato Province to catch freshwater fishes. This is a first record for a freshwater fisheries in Japan. In the summer of 675 year, TENBU Emperor ordered to prohibit fixing a brush weire to catch young fishes from April to the 39 th of September. The KAMMU Emperor (800 year, ENREKI 19 th Era) also made an information to many fishermen not to catch fishes in ponds by drying the waters away. During 1204 (GENKYU 1st Era), many "Samurai" took a fishing as his hoby and then the general fishing become enterprising gradually. The many fishing apparatus, net, brush weire, long-lines, harpoons, spears were used from the ancient time. Hooks were derived from needles to make a curvation at their tip. Various kinds of baits were used in old time. It is said that JINGÛ Empress used a piec of rice as a bait when the angled at Tamashima, Hizen Province during 860 Era. Earth worms as a land bait and "Kokahi" a kind of aquatic worms as a river bait, those were used from the old time. Anglings are divided River angling and Land angling. The other kind of angling is called "Unagi Ana-zuri" angling of eel in holes. This fishing is considered by the negative photaxitic habit of eel. In the day time, fishermen with a rod which line is loosely wounded at the point just below the hook around the tip of rod and slowly sends the rod into a hole or gap formed in the stone bank or others in the water. Then he carefully pulls out the rod so as to leave the hook there and waits for the fish to be caught.

The baits are choised for earthworm, crab, pond-snail, or cut-meat of Ayu-fish.

Nets used in freshwater fisheries was called "Ajiro" and mostly used in river fishing. They were once famous in Uji, Kyoto but now fall into disuse. Fish pound garth was used even in ancient time as shown in "Nihonki" and Jindaiki" (very clasical record book). From the various records of fishing, we recognized many freshwater fishes, as *Cyprinus carpio*, *Carassius auratus*, *Plecoglossus altivelis*, *Salangichthys microdon*, *Anguilla japonica*, *Tribolodon hakuenssis*, *Onchorynchus rhodurus*, *O. keta*, *Zacco platypus*, *Parasilurus asotus*, *Hemibarbus barbus*, *Pseudogobio esocinus*, *Pelteobagrus aurantiacus*, *Cottus kazika* etc. were caught. The same fishing methods of the Pre-historic age were used in this age and the freshwater fisheries were rather developed than the marine fisheries. The somewhat more fishing methods were considered as the freshwater progressive fisheries could carry out safety and easily to catch the fishes. The most primitive fishing method "Kaibori" was a question of that goverment in "Dazyôkanfu" on February, EMPO 19 Era. The poison fisheries were prohibited on June of Genkei 6 Era. The most active fishing method in that age was a kind of the set fishweire and the characteristic commorant fishing carrying out in Asia. The remarkable fact is the change of the material of the Harpoons, spears and hooks from bones and stones into iron. Seine was used in "Nara-chô Age" (710–794) in lakes and swamps.

Middle age: In this age, the kinds of freshwater fishes recorded from the shell mounds are increased gradually in numbers, adding to the former species with *Gobius*, *Zacco*, *Tribolodon*, *Chaenogobius* and *Misgurnus*. The fishing apparatus used in this age was nearly the same to those of the former age. It is worthy to note that the fish weir was used commonly in the large lakes or lagoons as the lake Biwa and Kasumigaura. Perhaps this fishing equipments is originated in this age.

The present time: In this period, the coastal fisheries were more developed than the freshwater fisheries. The kinds of freshwater fishing were rather carrid out chiefly for carp, crucian carp, Ayu-fish, eel and white fishes.

The anglings were developed for each different kinds of fishes, we had the special line-fisheries as carp line, smelt line, *Hemibarbus* line, Minnow line, Ayu-fish line, trout line, and eel line. These lines are somewhat modified for special fishes to angle very easily and developed for special fishing apparatus. The fishing gut used line material started in Kagoshima Prefecture in the latter period of EDO age and during KANEI and ANSEI Eras, this material was used commonly throught Japan. The three kinds of baits were used as live bait, fresh bait and artificial bait. The special brush weir are commonly using in the Lake Biwa.

The present time: In the present time, the marine fisheries are more prosperous than even and on the contrary the freshwater fisheries are somewhat on the decline. At the beginning of the present time, namely the early MEIJI Era, the shore fisheries, developed recently, attained the highest point and gradually are on the decline. Wherease in the middle of the present time, the off-shore fisheries developed and in the last time, by the encouragement of the open seas fisheries, the shore fisheries are changing into the open seas fisheries. After the war, the fishing area of the Japanese fisheries is limited and the open seas fisheries collapsed by the insufficiency of the material and the shore fisheries becomes in prosperity again. From the results mentioned above, the development of freshwater fisheries ought to be obstracted, and no body can show the

extensive progress of fishing apparatus and fishing methods. But only the line fishing runs in progress not only fishermen but also amartures who tried for their hoby, the fishing tackle apparatus also developed. In general, the freshwater fisheries seems not so well developed from the ancient time to the present when compared with marine fisheries even the stationary net fishery. Even in the lakes in proximity, the kinds of fishing apparatus are rather different in each other which may caused the progress of the fishing apparatus. If the peculiar fishing apparatus of each lakes is modified and developed, the freshwater fisheries may develope more thanthe ancient time. But we consider that the present conditions of Japanese fisheries and the aquirement of animal protein, the freshwater fisheries would be nessecity to develop. In future, the habit of each freshwater fishes must be researched and the light and sound sensibility of the fishes must be considered to use the physical and mechanical fishings. The recent scientific fisheries for freshwater fishes will develop from these researches.

b. Fishing gears

Fishing gear: In general, the fishing gears of the freshwater fisheries are numerous, but compared with those of the marine fisheries, they are less in numbers. Mostly the nets and traps are not so well developed. The freshwater fishery always has to be adjusted to local conditions. The most primitive types may be fish hooks and lines. They have been used from the ancient time for river-fishing. As regards the distribution and possible origin they may be divided into two groups, one of which consists of implements characteristic of the southern forms, chiefly found in southern Asia and Pacific islands; the other group includes implements which are of northern form, recorded in Saghalien, Kurile Islands and Alaska.

The fishing gears of the freshwater fishery are divided into three groups.

A). Nets including Traps. B). Hooks and Lines C). Miscellaneous Types.

A). Nets including Traps:

1. Gill nets or Entangle nets ("Sashi Ami Rui"):

a). Gill nets ("Sashi Ami") (pl. II. 1-3; figs. 3, 4) are used in Japan for a fresh-

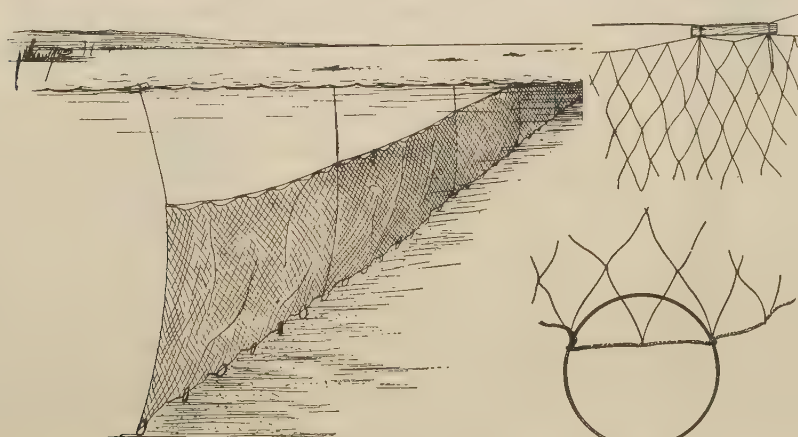


Fig. 3. Bottom Gill Net ("Soko Sashi Ami")
This gill net is called "Taketaka" or "Naga-Koito Sashi Ami used in" the Lake Suwa, Nagano Prefecture for Smelt fishing.

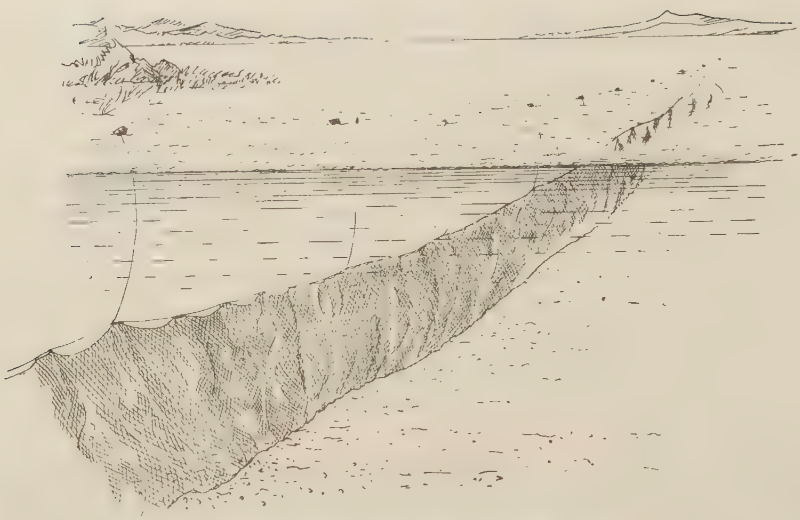


Fig. 4. Bottom Gill Net "Soko Sashi Ami"
This one kind of gill net called "Koito Ami" is used in the Lake Biwa, Shiga Prefecture to catch Small Ayu-fish.

water fishery and are designed for a much greater variety of species of fishes; such as Ayu-fish gill nets, Mullet gill nets, White fish gill nets, Carp gill nets, Smelt gill nets and Salmon gill nets. They are mostly using in lakes, swamps and reservoir to capture fish by entanglement. Carp gill net fishery is called "Harakami" at Kosan pond, Takakusa-gun, Tottori Prefecture. The nets are made of very minute fibre in units about 25 meters long and 0.5 meters broad. This fishery is carried out on fifty small boat with a fishermen on each to bring a net for fixing on a suitable ground. After that, all the fishermen knock the sides of the boats raising their voices and tracking after fishes to entangle by nets.

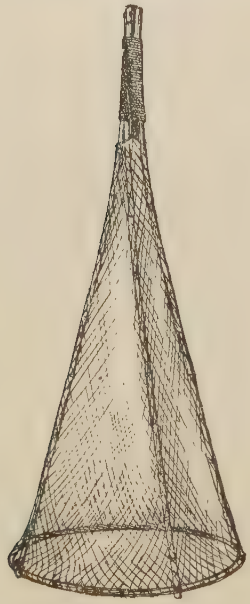


Fig. 5. Cover Net "Ooi Ami"
This is used in the Lake Biwa, Shiga Prefecture to catch carp, Crucian carp and other fish.

2. Cover nets ("Ooi Ami Rui") (pl. II, 4-6; III, 5; fig. 5):

a). Hand Casting Nets ("Tou-Ami"), a kind of Cover Nets. Hand casting nets are commonly used by fishermen andarmateurs for fishing in Japan. The materials are cotton, linen, or silk thread, with sinkers and light as the net is used by one person. These are designed to be able to be dropped from a boat or land over schools of fish, to be entrapped. They are used in rivers and ponds to catch "Ayu", Carp, Crucian carp and Mullet. The largest one measures 8 meters long and 45 meters broad around the opening. The round conical casting net is a kind of casting nets and is found in the coastal regions of the Indian Ocean. From the information made by ANELL, B. in 1955, it has spread to the Near East, parts

of Africa and all over the south-eastern, central and western parts of Europe. Towards the East it has been frequently instanced from southeastern and eastern Asia as far north as Japan. It is especially common in the Malay Archipelago, whence it was introduced, apparently rather late, to the western part of Melanesia, above all New Guinea. The round casting net was unknown in Micronesia and Polynesia in pre-European days. Later it was introduced by Chinese merchants, Japanese fishermen and European colonists.

b). Lantern Nets ("Chöchin Ami") (fig. 6): are a kind of cover nets and used chiefly in rivers and lakes. Fishermen look the fishes from the surface of water and drop over them. Fish are caught in the folds of net. The apparatus is lanter shape, made of the net measured 2–3 meters in height, fitted withina bamboo frame, have an opening one to two meters in diameter. Several modifications of the net are found locally. This net is used in Imbanuma, Teganuma and Naganuma of Chiba Prefecture and the River Tone, to catch eels, carp crucian carp and mullet.

c). The drift net "Nagashi Ami" which is used in rivers of Chiba Prefecture, is a kind of casting nets to catch salmon, trout and carp. The construction mostly resembles a casting net; measured 5 meters long and 20–32 meters diameter around the opening.

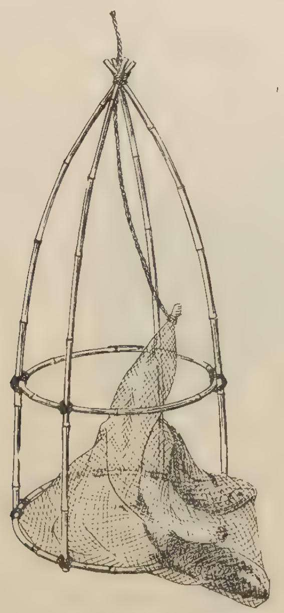


Fig. 6. A kind of Cover Net, or Lantern Net "Chochin Ami."
This is used in the Lake Biwa, other rivers and lakes to catch carp, crucian carp, mullet and other freshwater fishes.

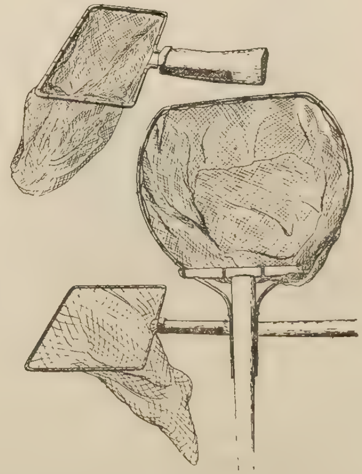


Fig. 7. Three kinds of Lift Net "Tama Ami" used in Lake, Biwa, Shiga Prefecture. 1. "Tedama" 2. "Higaidama" 3. "Zatsugyodama".

3. Lift nets ("Tama Ami") (fig. 7) Dip Nets ("Sade", "Tabu") (pl. IV, 5, 6; figs. 8-11):

They are simple kinds of nets which are used to screen small fishes and shrimp from the water. Perhaps, the nets are most primitive and have been used from the ancient

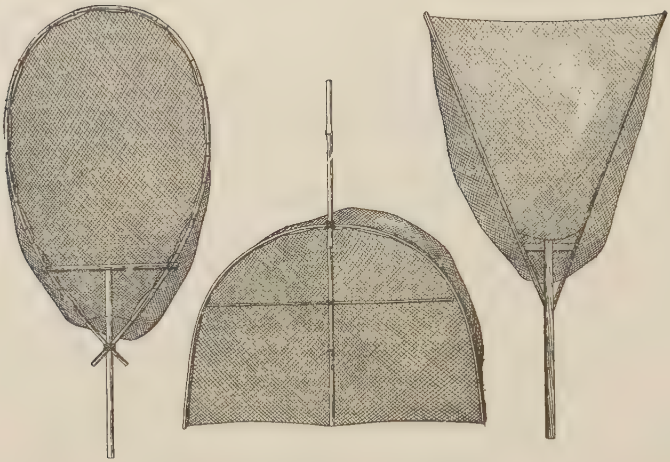


Fig. 8. Three Kinds of Lift Net ("Sade Ami") used in Lake Biwa, Shiga Prefecture.

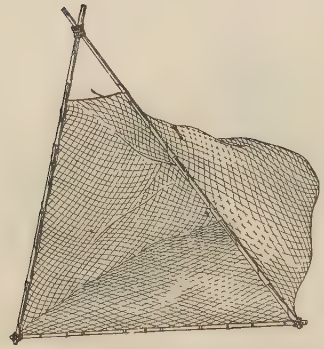


Fig. 9. A kind of Lift Net used in Lake Suwa, Nagano Prefecture.



Fig. 10. A kind of Lift Net called "Oisade Ami", used in Lake Biwa, Shiga Prefecture.

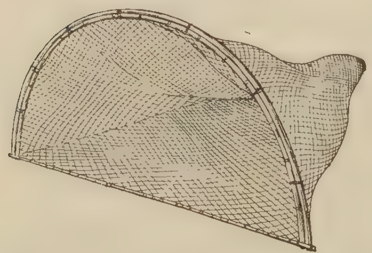


Fig. 11. A kind of Dip Nets "Tabu". This is used in Fukuoka Prefecture.

time to the present in Japan. They are called "Sade" or "Tabu" in some districts. Their sizes are very variable; from those handled by one man to larger ones managed by as many as nine hands with the aid of four boats. The nets are made of various material, such as netting attached to bamboo frames, or entirely of split bamboo. Sometimes, the dip nets are used for the actual capture of fish and shrimp in rivers, lakes and

ponds from the seaweed grounds of the shore waters. Lift nets are often used for catch ing "Ayu" when they are ascending the river in spring. It is an interesting fact that the net is used to catch jumping "Ayu" at water-fall of the River Arita, Matsubara-mura, Wakayama Prefecture.

4. Square nets or Four Angle Dip Nets ("Yotsude Ami") (pl. V, 1-4; figs. 12, 13):
They are called as Lever Nets, scoop or four angle dip nets. This is kind of scoop and is commonly used in broad rivers and lakes throughout Japan. They are made of cotton twine framed on bamboo poles, 1.5 to 5 meters long. The corners of the nets are lashed to cross bamboo rods. The rods are tied to a long bamboo pole which is used to raise and lower the net. Two-centimeter mesh is the suitable size for freshwater fishes. The net, worked either from shore or from a boat, is kept under water until fish swim over it. Then the net is lifted to capture the fish. Carp, Dace, Chub, Gobies, Mullet, Trout, Ayu-fish and other freshwater fishes are chiefly caught. Sometimes the baits (viscera of fishes and others) are ready in the net to induce and catch fishes.



Fig. 12. A small Square Net "Koyotsude Ami" This is used in Lake Suwa.

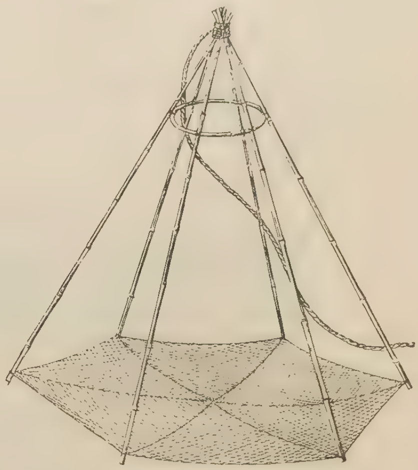


Fig. 13. A kind of Square Net "Shiki Ami" This is used in Fukuoka Prefecture.

5. Beach Seine and Trawls.

a. Towing nets, Haul net ("Hiki Ami"), Drag ("Jibiki Ami") (pl. IV, 1, 2; figs. 14, 15): For the freshwater fisheries, two kinds of the trawls are distinguished. (a) One is called a large beach seine ("Ô Jibiki Ami") which is hauled on to the wide beaches of a large lake, as at Biwa lake. (b) The other is called a boat trawl ("Funa Biki Ami") which is operated on boats in a lake. These nets dredge along the bottom of lakes to capture bottom-feeding fish. One edge of the net is weighted with sinkers, and the other edge is buoyed up with floats. Most of the nets have pocket bunts or cod ends of heavy and small meshed netting in which captured fish are held. Common carp, Crucian carp, Ayu-fish and *Hemibarbus* are chiefly caught. White fish (*Salangichthys*) is also caught with this net by using a bunt of very fine mesh.

b. The Salmon seine called "Kiritachi Ami" is used in the river Tokachi, Hokkaidô. It is consisting of three parts, pocket bunt, "wing deami" and "iriami". The net is



Fig. 14. A kind of Trawls "Isazabiki"
This is used in the Lake Biwa to catch Isaza-fish.

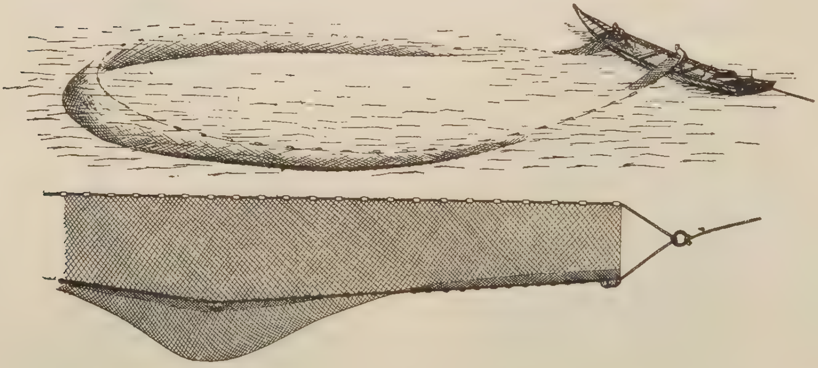


Fig. 15. A kind of Trawls "Nezuri Ami"
This is used in Lake Biwa to catch Carp, Crucian carp, *Ischikauia* and *Opsariichthys*.

very large, measuring 65 meters long. It is hauled on the a beach by many fishermen.

c. The Ayu-fish Seine is used in the Tama River, Kumamoto Prefecture to catch Ayu-fish in the deep and slow current ground with many pebbles on the bottom. The net is 5 meters long. This fishery is carried out by ten boats, sailed out by two fishermen with a net on each and starting from the shallow grounp to the middle of the river over the other shallow ground again to haul the net on the beach.

d. Salmon Drag Net is a fishing with aid of "Sake Tome Jibiki Ami". The present fishing is practised with the aid of weir placed across a river to block the salmon, their upstream migration. The weir is often substituted by wing nets or drag net. When salmon gather numerously below the weir, another weir is established across the river at an appropriate place downstreams. Then, the fishermen operate a drag net to catch the fish thus besieged in the site from upper to lower reach of the flow. This is carried in the River Miomote, Niigata Prefecture and the Rivers Tsugaruishi and Otsuchi, Iwate Prefecture during September to January for salmon fishing.

e. A drag-net fishing in frozen lakes "Hyoka Hiki-Ami". This fishing is mostly car-

ried out in the northern part of Japan such as Hachirôgata, Akita Prefecture and Ogawara-numa, Aomori Prefecture. This is consisting of a pair of wing nets, a bag net, warps, and bridle. Wing net 35 m long and 3 m high. Bag net 8m long. Before starting fishing, two large holes and a series of small holes alined between them are cut open on the ice. The two large holes, measuring 1.3–2m and 3–5m respectively, are usually made some 1 km apart from each other. The net is cast into water under the ice through the smaller hole of the two, and the warps are stretched under the ice by means of pole, hook and bridle, from one hole to another, toward the large hole in the end. When the ropes reach the final hole and the wing nets are fully stretched, the pair of warps are hauled up by 8–10 fishermen. This fishing is carried out during January to February to catch carp, crucian carp, pond smelt, goby and other freshwate fish in the lakes.

f. Hand-operated Trawl, "Daitoku Ami". This net is a special trawl used in Lake Kasumigaura to catch pond-smelt, white fish, carp and crucian carp. This drag net is very large, provided with two long wing nets, 500–1,000m length. The gear is operated by the use of 3 boats; two of which have a winch and one without. One of the two boats with winch sets itself by ropes and a stake driven in the bottom at an appropriate place. Then the second boat of the two, standing still aside, spreads the nets around a shool of fish, and fastens itself with ropes to the stake planted some 40m apart

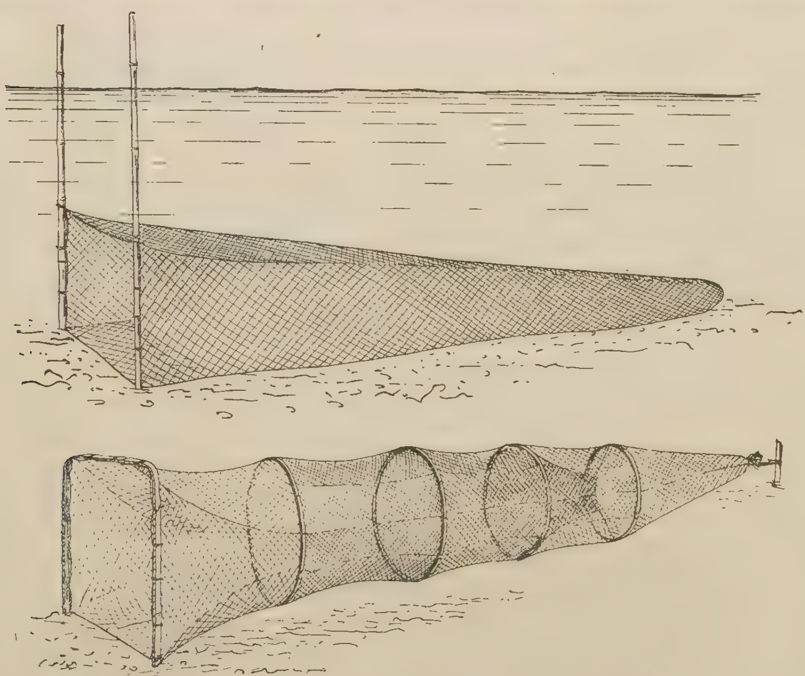


Fig. 16. A Long Bag Set Net "Nagafukuro Ami".
1. A small Set Net "Dashi Ami" without wing sinker, is used in rivers and lakes to capture carp, crucian carp, cat fish and Ayu-fish.
2. A larger Set Net "Hari Ami" is used in lakes to catch carp, crucian carp and other freshwater fish.

from the first stake. After the preparations, the net is hauled by means of the winches loaded. When the warps are pulled full length, the third boat detaches them from the net and re-fastens it at the place where they are fully stretched. This operation is repeated until the cod-end is hauled in. Whole operation is conducted by 10–20 fishermen 3–8 hours. The net is sometimes operated from beaches under a similar principle.

6. Small set nets ("Hari Ami" and "Dashi Ami") (figs. 16, 1, 2):

The nets are a kind of set net without leaders or fences. The "Hari Ami" has short wings and a pocket built on the fyke net principle. There are several kinds of the net according to the different ways to set. One called "Sebari Hari Ami" (fig. 16,2) is set along the beach of a lake on one side and the other in the river. The other kinds of set nets are "Eel set nets" and "White fish set nets". They are designed to entrap fish. The "Dashi Ami" (fig. 16,1) has no wings and is used without sinkers and floats. It is fixed to the bottom with bamboo sticks. Ayu-fish, Eel, Gobies, Mullet, Shad and other fishes are caught in it. The pocket net is a kind of set nets and is used in the river Hamada, Sufu and Misumi, Nakagun, Iwami Province, Hokkaidô for catching Eel, Carp, Cat-fish. This fishery is carried out in the night. This long pocket shaped net is made of linen and has no leaders and fences. It has short wings and a pocket built on the fyke net principle. It is set fixed to the bottom with bamboo sticks. The net pound cage is a kind of this group for small scale fisheries and varies in the construction by localization. A net called "Sakado" at Chito River, Inada Province, Tottori Prefecture is to capture Ayu-fish and Dace. The net is made of linen and has short wing on both sides of the opening and a long pocket with two or three bamboo rings. It is set fixed to the bottom with bamboo sticks.

7. Fish trap (pl. VI, 1-7, pl. VII, 1-6; figs. 17-23):

a. The basket trap "Uke" is a small or intermediate one used in the streams and lakes. It is cylindrical, pointed at one end and with a funnel-shaped passage of bamboo spikes converging inwards at the other end. It is made of finely split bamboo or linen net "Mondori" or "Amiuke" (pl. III, 1–2; figs. 18, 19) held together with cotton thread, hemp-palm rope. A bamboo pole is lashed to one of its sides for the attachment of ropes. Two ropes are used, one tied to the closed narrow end of the trap and the other to the pole. It is provided with a funnel opening shaped for fish entrance. The size and shape are variable by locality and according to the fish species, fishing grounds. An "Uke" (figs. 20–21) used in the lake of Biwa is ordinary 52 cm in length and 13 cm in diameter. The biggest "Uke" is used in the River Kuzuryu, Fukui Prefecture, in the heavy current waters, to capture large Cottoid fish (pl. II, 7). It is about 6 meters in length and 1 meter in diameter of the opening, set in the middle of the river by a long stout pole which fixed on the beach of the river. Most of the ordinal shaped "Uke" are set individually, but sometimes several "Uke" or even as many as several handreds of them are connected each other in a line. They are set in shallow waters of lakes and rivers, depth within 2m generally preferred. As mentioned by HORA, S. L.*, the method of using the trap is different by the behavior of fishes. The open end is placed downstream during the breeding season as the fish ascends the river. Off the breeding season, the open end is placed upstream. ANELL, B.

* HORA, S. L., 1921: Records of Indian Museum, vol. 22, pt. 3, p. 211.

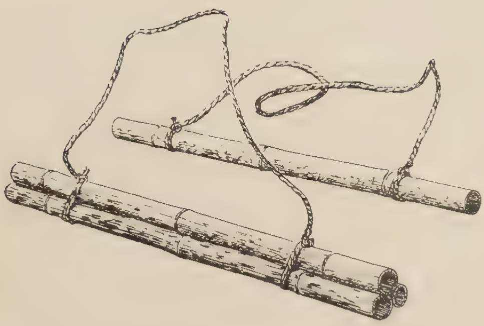


Fig. 17. Cut Bamboo Trap for eel ("Unagi Ue"). Katata of Lake Biwa, Shiga Prefecture.

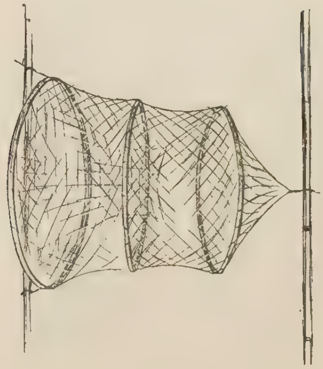


Fig. 18. A smaller Net Fish Trap "Mondori" This trap is used in the shallow water of the Lake Biwa to capture mostly carp and crucian carp.

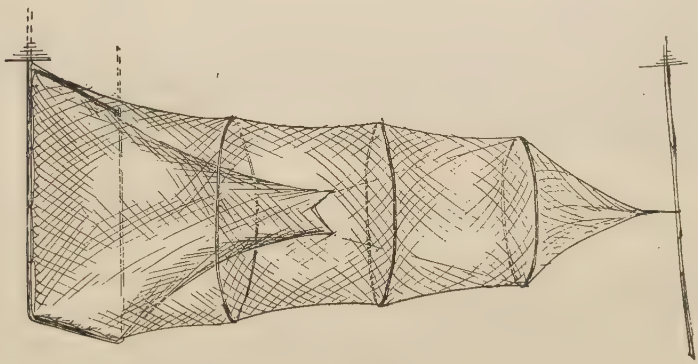


Fig. 19. Net Fish Trap "Mondori".
This trap is used in the shallow water of Lake Biwa to capture carp and crucian carp.

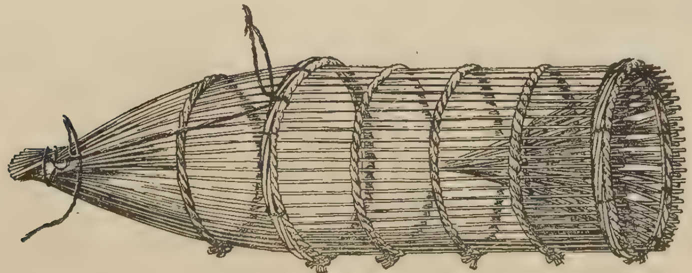


Fig. 20. An ordinal Basket Trap used in Lake Biwa, Shiga Prefecture.

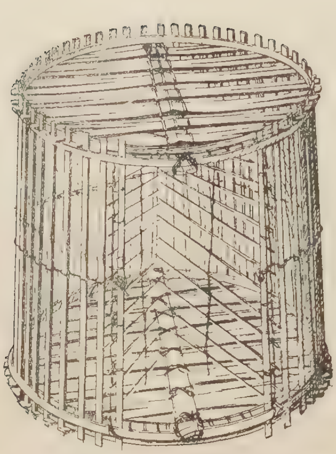


Fig. 21. An ordinal Basket Trap used in Lake Biwa to capture carp.

(1955) reports that the plunge-basket originate in all probability in India. From this area it has spread to Africa and parts of south-eastern Europe in the west, to south eastern Aisa, including Indonesia, the Philippines, Malacca, Indochina, China, Korea and Japan, in the east. Finally, it was introduced in Melanesia, chiefly those parts which border upon Indonesia, by New Guinea and some of from the Pamo in California and from Tribes in Gwana, Brazil, El Gan Chaco and eastern Bolivia. It has been presumed that the plunge-basket in South America was introduced by runaway Negro slaves. As regards the Pomo basket we have pherhaps the reckon with European influence.

b. Eel trap: ("Unagi Ue"). (fig. 17): This equipment is of very primitive form, having been used

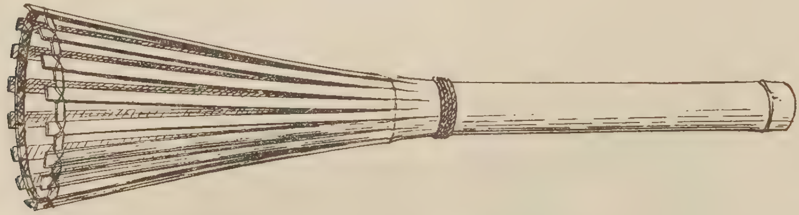


Fig. 22. A kind of Basket Trap ("Kudari") used in River Yoshino, Nara Prefecture, to catch trout.

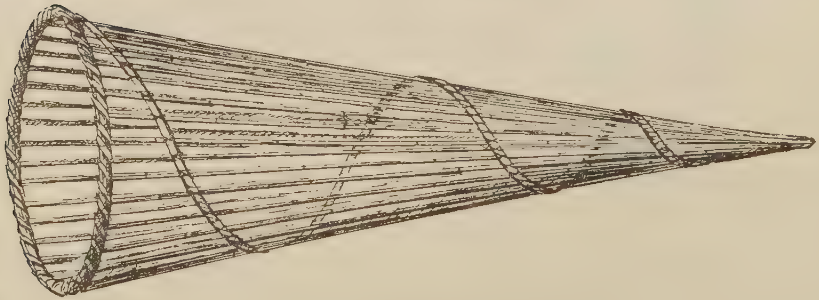


Fig. 23. A kind of Bamboo Fish Trap "Mondori". This Bamboo Fish Trap without funnel shaped tunnel is used in River Yoshino, Nara Prefecture.

from the ancient time of Japan for eel. By the account of the records of old natural history of Janan as "Kojiki" and others, this equipment was used in rivers and lakes. This is made of cut bamboo held together with vines or cotton twine and has no funnel inside. The fishes entering the trap are prevented from escape by the funnel shaped tunnel "Kaeshi". These set in lines consisting of many traps on the shallow bottom of lakes and rivers. They are usually set at night for the removal in the morning. Alth-

ough designed for catching, cat fish, carp, crucian carp, eels and lampreys often taken. This trap is common throughout Japan.

c. Carp trap ("Funa Ue" or "Tappe" pl. VII, 3–4): This trap is somewhat modified with eel trap forming cut cylinder in shape with a mouth on lateral side near base. This is made of split bamboo held together with vines or cotton twine. The fishes are also prevented from escape by the square shaped tunnel. Traps are set in lines with 20 or more to a line. The fishing operations are carried on during the daytime than at night. The baits (rice bran or silkworm cocoons "Sanagi" are used. Dace, minnow and other small fishes are also caught together with crucian carp. They are used in lakes throughout Japan.

A series of characteristic traps are used in running waters for capturing large quantity of fish. A trap consits of three parts, each performing a definite function. The first part consists of a superficial dam, built with bamboo poles and extends almost across the stream, leaving only a passage for boats. To the upper edge of the poles, just at the level of water, nemerous traps are fixed close together. The "Uke" thus acts as a sort of a purse for all the fish that enter the trap and is detached from time to time and emptied of its contents. By this elaborate arrangement all the fish crossing the dam near the surface are trapped. A pound cage was called "Uke" in Japanese, but the significance was uncertain. According to "Manyoshû" (published in 759), this fishing apparatus was used in the River Uji, Kyôto, with bamboo screens or bush woods blocking both side of the river coast and placing it in the center of the river so as to connect both barries. The fishes run in the center of river and caught by pound cage. This fishing has ever been adopted down to recent days.

d. Box Trap "Jindô" (pl. VIII, 1, 2):

This box trap is used in the River Yoshino, Nara Prefecture to catch carp, crucian carp, minnows, Ayu-fish and other small fishes. The construction of the trap is somewhat complicated. It is rectangular in shape 85 cm in length and 50 cm in breadth and is made of split-bamboo and wooden board. It is provided with a furmel-shaped fish entrance, measuring 15cm high and 45cm broad at one end and an opening at the other end. The fishermen put the trap, baited with rice bran, silk-worm pupa or other fish food and with stone sinkers lashed on both sides or put inside, are summerged in the shallow somewhat current waters along the coast of rivers. Traps and seine nets have proved disadvantageous for taking fish in ponds for occasional control catches. The traps used in freshwater fishery are less uniform than those used on the sea. It would be necessary to improve their efficiency. The large traps, recently described to be used especially for eel and dace fishing in lakes, are a combination of an entrapping chamber and fyke net. The other traps are consisting of 2 entrapping chamber.

B). Hooks and Lines "Tsuri" (pl. IX, 1-6; figs. 24, 25): The fishing with hooks and lines are probably is one of the oldest forms in the world. In Japan, the fishing with baited line seems to be primitive. It is very simple and requires not more than a line and couple of worms. For line fishing, the floating line, hand line, and set long line, as used by the commercial fishermen, are descrebed.

1. The simple fish-hook is known in most parts of Oceania. ANELL. B. (1955)* di-

* ANELL, B. 1955: Contribution to the History of Fishing in the Southern Seas. Studia Ethnographica Upsaliensia. IX.



Fig. 24. A recent Harpoon used in Lake Suwa, Nagano Prefecture.

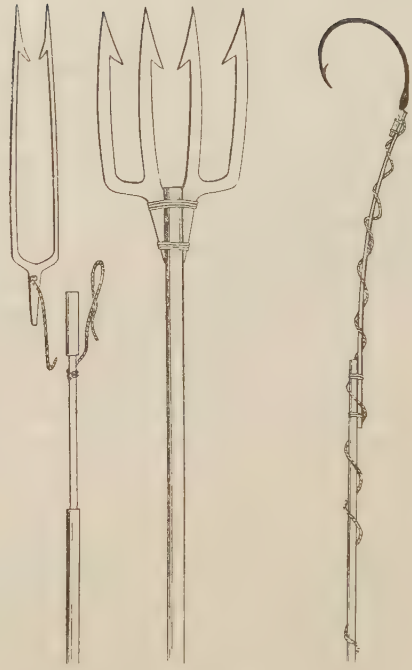


Fig. 25. Two kinds of Harpoons "Yasu" and a Spear. "Kagi".

1. A recent slender harpooon used in River Miomote, Niigata Prefecture to catch salmon and trout.
2. A recent harpoon used in River Uono, Niigata Prefecture.
3. A spear used in rivers of Niigata Prefecture to catch salmon and trout.

vided the types of fish-hook used in Oceania into three, Melanesian, Polynesian and Micronesian types. He also reported that the Polynesian and Micronesian hooks belong to a much later stage in the development of the hook than the Melanesian types. The latter correspond to the primitive mesolithic hooks of Europe, the oldest types found in prehistoric Japan. The Melanesian types of simple hooks are very primitive, often made of thorns, bird's claws, spurs of beetles. Some are made of mussel-shell, bone and turtle shell. As regards the line attachments the Melanesian hooks are much inferior to the Polynesian ones. They consist usually of a simple notch, grooves, a top of knob and the like. Mostly the Melanesian hooks are of common U-shape, though many of the heat-treated turtle-shell specimen may be classed as round. The Polynesian and Micronesian simple hooks are more developed than the Melanesian types. The bone specimens are always U-shaped, the hooks of turtle-shell and pearl-shell either round or U-shaped. HIYAMA, Y.* described that the numerous kinds and shapes of fish-hooks used in Japan. The fishermen of the Southwest of Japan prefer curved hooks; those

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* HIYAMA, Y. 1947: Japanese Fishing Gear. Gear Headquarters Supreme Commander for the Allied Powers Natural Resources Section Report No. 71, 1947, Tôkyô.

of the Southeast prefer angular hooks; and those of the Northeast prefer long shaped hooks. The curved type is generally used in freshwater fisheries. ANELL, B. also reported very interesting facts concerned with the simple hooks used in prehistoric Japan. The simple hooks of antler appears to have been very common in all prehistoric period. The bone hook probably arose in northern Eurasia, whence it spread to Europe, parts of the Near East, to Japan and Across the Bering Strait to America where it is known as far to the south as in northern Chile. The primitive types were still reported to in most of the tropical regions. All Japanese hooks are U-shaped, and especially in the older specimens the form is completely symmetrical with shanks of equal length. Some have incurving points. The oldest type of barbed hook is considered to be that of a squarish U-shape, with a top knob and a spur-like barb in the prolongation of the point-leg, namely the type of outer barb that presumably did not function as a barb in the technical sense of the term. The next step in the evolution was the application of several outer genuine barbs, after which the inner barb finally makes its appearance, at first in combination with outer barbs, then alone. The final phase is thus the U-shaped hook with one inner barb. This inner barb is always placed very far down on the point-leg. For the rest, also specimens with double inner barbs have been formed; and what is here of particular significance is the fact that on hooks from the final "Jomon" period this appliance is not, as with regard to Europe and North America will later be shown. As regards the line-attachments, these consist as a rule of one or two pegs on the back of the shank. The typical Polynesian line-attachment with a triangular peg a little below the shank-top, which tapers to a point, is rather common in Japan.

2. The hand-line ("Tezuri") is in common use and has several distinctive features. The lines are usually of common "Tengusu" (produced by "Tengususan" a kind of insect worm) sometimes of cotton, or artificial nylon. The length is much greater than any line used in conjunction with a rod. A lead sinker is fastened upon the line. Line fishing is divided by the method of fisheries. There are many kinds of lines called "Dobuzuri" "Tenkarazuri", "Tenbinzuri" "Anazuri", "Tomozuri" "Kebarizuri" "Ayuezuri" "Unagizuri", "Namazuzuri", "Korokorozuri", "Bakudanzuri", "Yokogake", "Chongake", "Meganezuri" and others.

3. The most important means of fishing eels and bottom fishes in the lakes, is the long line "Hai Nawa". A long line made of kemp is equipped with smaller lines of nylon or perlon at distances of 1 to 1.5 m. These are each provided with very small hooks and put straight across the river or on the bottom of lakes and ponds. Since the Rainbow trout and Brook trout were successfully introduced into the lakes and streams throughout Japan, they have become favourite resorts of foreign flyfishers who makes use of the local form of coracle in order to move from pool to pool. The ingenuity of the Japanese angler reaches its highest expression in the matter of baits. He comprises everything he can think of to tempt fish to his hook through the senses of sight, smell and taste. For his hooks, the favourite animal baits are as follows but should be selected by the different species of fishes. The commonly used baits are as follows:

Species of fish	*Kinds of baits*
Salvelinus pluvius…………	Earth worm, Glasshoper, Insect larva, Spider.

Zacco platypus
Zacco temmincki ....Shrimp, aquatic insect larva, wheat powder.
Opsariichthys uncirostris ...Cottoid fish and small fishes.
Ischikauia steenackeri ......Wheat powder and earthworm.
Acheilognathus moriokae ...A kind of macaroni, aquatic insect larva.
Parasilurus asotus ....Frog, earthworm, minnow, goby, and other small fishes.
Anguillia japonica ....Loach, earthworm, minnow, small crustacean.
Carassius auratus ....Earthworm, shrimp.
Cyprinus carpio ....Annelid, potato, pumpkin, mud, snail loach, rice powder, small fish, bread.
Plecoglossus altivelis.........Aquatic insects,
Sarcocheilichthys variegatus Eartiworm, aquatic insect larva, *Corbicula* vivalve.

Many kinds of artificial baits are made of bird feathers stained with color solution to make an outer feature resembling different kinds of water insects, for which freshwater fishes are selected.

The value of ground baiting is so well understood that the manufacture and use of appropriate mixtures have been brought to a high degree of specialization. The mixtures employed consist essentially of strong-smelling substances bound up in clay or dough, in order that the diffusion of the ordour shall proceed comparatively slowly.

1. Harpoons and Spears. ("Yasu" or "Mori" and "Kagi") Miscellaneous Types (figs. 24, 25): These implements are also primitive and were used in prehistoric Japan. The Marquesan harpoon was used early in 1804 in Polynesia, made of hardwood or of human bone, as a rule, of femur. It had a long, not particularly sharp, point with a couple of barbs on either side. In between these a hole for the line was drilled. Even in the present time, harpoons and spears are used chiefly in Japan. (fig. 10, 1, 2) A particular type of them is a salmon fishing harpoon used in the rivers of Hokkaidô by Ainu people. This soft of harpoon consists of a pole 3 to 4 m in length. Here the head is inserted, being stuck fast with a rubber like substance. The head is made of iron. It is triangular in cross-section, and below the actual point there are four short barbs at each of the three angles. When harpooning from the boat, the Ainu fishermen plunge at the prey of salmon. The pole is very long and the line has need to be attached to the harpoon. This fishing is widely adopted in Hokkaidô by Ainu people. They also use the spear which is called "Mariip", provided with a sharp pointed end. When they plunge at a salmon, the spear is inserted into the body of the salmon, preventing the spear lashing from slipping off. The point was made of bear hone in old times and now of iron into a same shape. The spears (figs. 24, 25) used in the rivers and lakes are of many kinds, some with two prongs, others with several (3 to 5). The former is used in spearing salmon and trout, and is known as "Mori" or "Yasu". It consists of long wooden stick bearing iron prongs at one end and tightly fixed by wedges at the other end with strong rope. The handle of the spear is about in length, while the total length is five meters.

Buschan, G., 1938: Kulturgesichte Japans. Wien, Leipzig. 1938, p. 27.
Groot, G, J., 1951: Prehistory of Japan. New York. 1951, figs. 6, 10 B.
Munroe, N. C. 1908: Prehistoric Japan. Yokohama. 1908, p. 142, figs, 27; 1-2, 51.

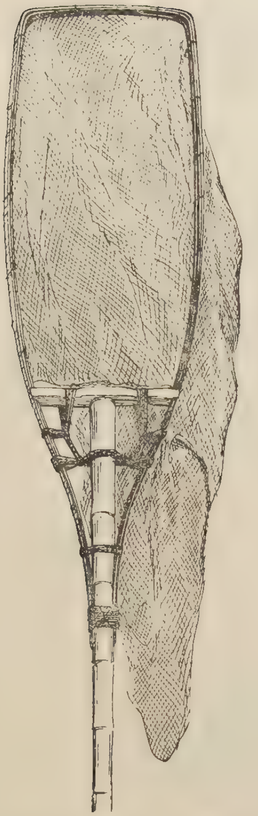


Fig. 26. A Dip-Net "Erikaki dama" is used to scoop fishes when they are in the dead ends of labyrinth of the bamboo screen. This is used in Lake Biwa, Shiga Prefecture.

2. Weir group (pl. X, 1–6; fig. 26):

a. Common fish Weir "Yana" (pl. X, 1–6). This large fish weir consists of two parts: two small barriers and a screen. The size and form of this weir as well as the fish aimed very locally. In the shoal of a stream with rather rapid flow, two small, low barriers are constructed, each half way across the river, from either bank diagonally toward down or up-streams so as to concentrate the water flow between them, and split-bamboo screen is spread slopewisely on a wooden frame planted on the bed. By rapid flow running between the two barriers, fish are either driven or washed up on the screen. This weir is mostly used to capture the "Ayu" when he gose down the mouth of a river to spawn during the end of September and October.

b. Weir with "Kattori" trap ("Kattori Yana") (pl. XI, 6): This weir consists of two parts: a small earthen dam and the so-called "Kattori Trap". The dam, on which bamboo fish screen is planted, is made of piled sand-bags and arched towards downstream. It is also built higher in the middle and is sloped toward both ends so as to attract more water flowing over there. The gate-way of the "Kattori Trap" is installed on both banks contiguous to the weir, through which water, together with fish, is led to fall into the trap or a kind of fish reserve. Fish, reaching before the dam, are finally carried to both ends, and fall in the trap. This trap is used in the Ado, Chinai and Ishida rivers entering Lake Biwa to catch young "Ayu".

c. Weir with small boxes and supplementary barrier (pl. XI, 5):

A weir of this type is composed of barrier and small wooden boxes opened. The barrier is consisting of bamboo fish screen supported by big wooden piers. The boxes opened at the top, are set at appropriate interval across a river. They are constructed during the season from the end of spring to the beginning of summer when small Ayu "Koayu" in the lake of Biwa ascend the river. Koayu-fish, thus reaching in front of the barrier, they jump up and run into the small boxes.

d. Other kinds of weir: The other kinds of weir are used in different location. The weir with bag nets "Tsubo Yana.' is used in the rivers of Nagano Prefecture to catch Ayu-fish, loach and eel. This is of smaller size, practically resembling the common weir except the bag nets of the former. The bag nets are hung down from the split-bamboo screen platform. The small weir with water shoot "Toi Yana" is the smallest, composing of stakes, stones, and a split-bamboo fish screen. This is used for Ayu-fish, loach, sculpin, eel, goby and other small fishes to catch during June to November. The other complicated weir with traps and supplement barrier "Ukeyana" is used in

the rivers Kuma and Kawanabe, Kumamoto Prefecture, Kyûshû. This is composed of two barriers, standing face to face across a river, one with traps in a row and the other supplementary to the former. This is used mostly to catch Ayu-fish.

3. Screen group (pl. XI, 1–4; fig. 27):

a. Bamboo screen labyrinth "Eri". This screen trap is used in many large lakes as the lake of Biwa, Shiga Prefecture; Kasumigaura, (Ibaraki Prefecture) and the lake of Shinji, Tottori Prefecture. The construction and size of the set vary from small to large, some exceeding 1,000m in length, or from the single type to the multiple one consisting of two or more sets. Other types with net labyrinth are set in some lakes. The number of labyrinths also varies with their types from two in the typical one to 16 in the four-fold one, most of them being two, four and eight. This screen is set in fish passage along the coast to capture carp, crucian carp, minnows, Ayu-fish fry, eel and shrimp in large lakes. The capture of fish is made at the dead ends of labyrinth, scooping with dipnet, ("Erikakidamo" fig. 15) usually twice a day, in the morning and evening. Sometimes, small traps are inserted in the dead ends to catch small fish.

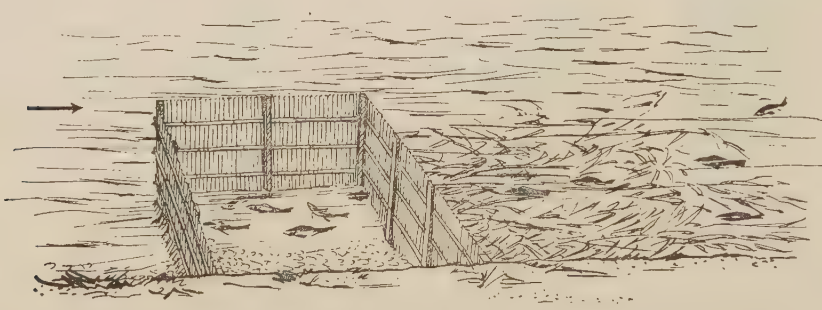


Fig. 27. Small primitive modified Screen Pound Net "Kodo", used in rivers of Niigata Prefecture to catch ascending salmon.

b. Bamboo Screen Pound "Sudate". This bamboo screen pound is designed to lead fish into the dead ends as a bamboo screen labyrinth where they are scooped up by dip nets. The size and shape vary individually, but are usually, 15–20m long on the fence. It is set along the coast of lakes, marshes and rivers to catch carp, crucian carp, cat-fish and other freshwater fishes in all the seasons.

c. Reed Screen Pound Net "Moppa". This is particularly used in the lake of Hachirogata, Akita Prefecture to catch carp, crucian carp, goby, young mullet and pond smelt. This is one of the "Eri" type set net, and the bamboo screens of the "Eri" are replaced by reed screens, some 1.3 m high. The fence net measures 200–300m long and pound, with an entrance of 30cm wide, occupies the area of 1.3 m square. This is set in fish passage and kept at the same place for all the seasons of the year, to catch fish in their breeding season or on their seaward migration from the lake.

d. Small primitive modified Screen Pound Net "Kodo". (fig. 27): This is particularly used in the river Okawa, Okawadani-mura, Iwafune-gun and in the mouth of river Tainai, Tsukiji-mura, Kitakambara-gun, Niigata Prefecture. This is a very simple type of an "Eri". The bamboo screens are set in the area 1m 30 broad and

1m 60 long along the coast of the river and fresh bamboos also are set in the lower waters near the screen pound net. When salmon ascend the river and take a rest in the bamboos, the fishermen catch them by hooks.

3. The Cedar-lined Trap (pl. VIII, 4–6) consists of a conical basket lined inside with cedar tree or some other pine trees. A fish swimming in through the opening at the bottom can hide in the innermost part of the basket. This trap is used in the small lakes and ponds of Gumma Prefecture to catch carp, crucian carp, minnow and other small fishes during winter.

4. Stone Mound Fishery "Ishizuka" or "Yatsuka" (pl. XI, 5–6; fig. 28):
Stone mound is quite peculiar fishing equipment carried in the lake of Suwa, Nagano Prefecture, Gumma Prefecture and Lake Shinzi, Tottori Prefecture. It is built with its top leveled a little below the water surface on the ferin, flat river or lake bed, where excavation of gravel is made first to receive the mound. The mound is sometimes covered with a straw mat to lure fish therein. When the fisherman see enough fish lured in the mound, they surround it at a distance of some 50 cm from the edge of mound, with a split-bamboo or reed fence, to which 1–6 traps are attached. Then they take off stones one by one so as to drive the fish into the traps. This fishing mound is divided into two kinds, one is called "Ozuka" and the other "Kozuka" by the

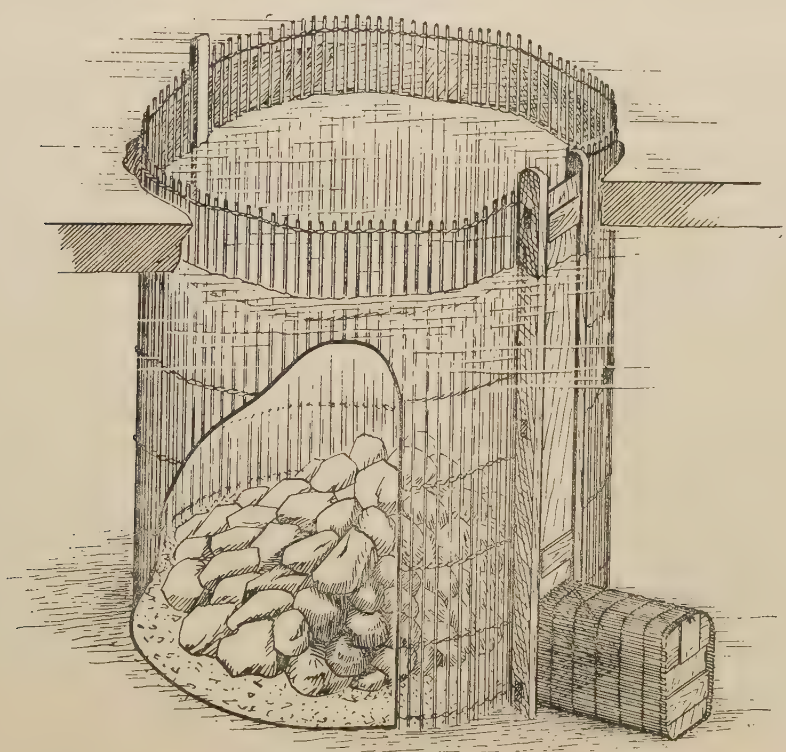


Fig. 28. Stone Mound fishing ("Ishizuka" or "Yatsuka") used in Lake Suwa, Nagano Prefecture.

size. Ozuka or larger mound has a size of 2–3 m square at the base and consists of 800–900 large stones, as large as 30 cm in sise. "Kozuka" or smaller mound comprises 200 ·600 stones almost as large as human head, and occupies 2–3m square at the base. This is used for crucian carp, minnows, cat-fish and shrimp.

1. The Cormorant Fishing (pl. XII, 1–6) is one of the peculiar fisheries by animals trained to fish. The ancestral man living in the stone age, when bungry and eager to enrich his depleted larder for the sweet tooth with some fishes playing about, he sometimes went out in shoals. Some he may have caught by hand a method not unprofitable when practised in shallow streams. The Japanese appear to have borrowed cormorant fishing from the Chinese at a very early period, certainly no less than 2,000 years ago, probably much earlier. In 467 (the age Emperor YURYAKU), the Japanese goverment sent a river guard of cormorant fishermen to Tanagami coast. About 37 houses of the fishermen did fishing of cormorant to supply fishes for the government. In other districts also, the cormorant fishings were carried out; in the River Tanigami, Ôhmi Province, the Ioki River, Ise Province, the Mehi River and Saki River Echû Province, and Shura River, Echizen Province. This fishing was continued till the middle age and the most famous grounds are the River Yoshino, Ôhi and the Katsura at that time. In these ages most of "Samurai" were very eager to do the cormorant fishing as their hobies in many districts. The villages where the cormorant fishermen lived, had scattered in various provinces, one of most prosperous fishing grounds was Mino Province. In these periods (990–994 years) many poets formed ideas from the cormorant fishings in many cases. The cormorant fishing is going to decay gradually at the present and remain a very few grounds as Nagara River, Tama River and others. After the war, the Japanese have exploited this method of fishing on an extensive scale and even tagged on a secondary. Gifu, on the River Nagara, is the chief centre to-day of cormorant fishing in Japan, both in its primary aspect as sport and in its secondary as a tourist attraction. With a few exceptions, the boats, about 12 meters long with a beam of 3 meters, are controlled by a crew of four men. The head fisherman stands at the prow, wearing a peaked head-dress and a ceremonial kilt of dried grass, and burning in a brazier hung from the end of a crane-arm. He must regulate the course to tend the lines, twelve in number which control the work of the same number of cormorants. Before the fishing begins each bird has its harness put on, a matter of much delicacy, for the cormorant has to be coaxed into submission. But the master-fisherman placates the bird, the while he adjusts a ring of metal or rattan or cord around the lower part of the neck just big enough to enable the bird to swallow small, underseized fishes, yet too narrow to permit the passage of those marketable size. At the back, between the wings, one end of either a strip of whalebone or of pliant bamboo, about a foot long, is fastened to the gullet ring; this srip serves as a convenient handle when lifting the bird from the water. As the master-fisherman has to look after the fishing of twelve birds, it requires unwearied and skilful attention and the extreme dexterity of super-nimble fingers while holding these twelve lines in the left hand, to use his right in the constant effort to prevent them from becoming hopelessly entangled. The cormorants are tamed by fishermen but they are exceedingly jealous of their rank. The fishermen catch the natural sea cormorants on the way of migration. When the cormorants are

tired by the long trip and take a rest on the rocky hill along the sea coast of Tôhoku district (north-western part of Honshû), the fishemen hiding at the back of the rock catch them with their hands easily. Then the fishermen bring them back and wash in lime water to make them clean and begin to make the training. The oldest and most skilful bird is called "Ichi-ban" (means Number one). His position is on the overhanging prow. As the fishing progresses the master keeps a keen watch upon his team, spread out fanwise in their search for fish. When one is caught, the bird's head emerges from the water with the fish held crosswise in its beak, then, deftly, it is swallowed head first. If small, it passes the ring and if too large to pass, it remains in the gullet pouch. The master hauls in the particular leash, lifts the bird from the water by its bamboo or whalebone handle and, with a deft motion, up-ends the bird and with adroit pressure forces it to disgorge the contents of the pouch, 3 to 7 at a time if fish be plentiful. After that, the bird is returned to the water.

4. Zoogeographical Analysis of Freshwater Fish Fauna

a. General historical Studies and Discussion of the geographical Distribution of Freshwater Fishes in Japan

Before we describe the details of the geographical distibution of the Japanese freshwater fishes, the general historical review of the distribution need to mention in here. In 1901, D. S. JORDAN[1] indicates that the freshwater fishes of Japan closely related to those of the Asiatic continent and the fishes in southern part of Japan also related to Chinese elements. He also divides Japan from the geographical distribution of fishes into Southern and Northern districts, and the transitional district including a wide area between Bay of Matsushima, Miyagi Prefecture to the mount Fuji, Shizuoka Prefecture. He has pointed out that the BLAKISTON Line in Tsugaru Strait has no more important significance as mammal and aves. In 1918, T. KAWAMURA[2] divides the distributional area in Orient, into Oriental Region and Palaearctic Region. He also comments a broad transitional zone, as shown the districts between western part of middle Honshû and Tanegashima or Yakushima. During 1929 and 1931, SH. TANAKA[2][3] announces the distributional region of Japan into three, Southern, Northern and Hokkaidô. He also describes on the demarcation of southern and northern part of Japan as the Tone River district on the Pacific coast of Honshû (Chiba and Ibaraki Prefectures) and Hamada and its vicinity on the coast of Japan Sea. Though he recognizes the BLAKISTON Line between the northern part of Honshû and Hokkaidô, he indicates the elements of the northern part of Honshû extend into the southern part of Hokkaidô as Hakodate, Muroran and Otaru districts. The freshwater fish fauna of northern and southern Japan is originated from the Chinese continent including

1) JORDAN, D.S., 1901: The Fish Fauna of Japan, with Observation on the geographical Distribution of Fishes. Science. 2nd Ser. XIV, pp. 545-567.
2) KAWAMURA, T., 1918; Nihon Tansui Seibutsugaku, vol. 1.
3) TANAKA, SH., 1929: Gakujitsu Kyôkai Hôkoku, V, pp. 243-257.
4) TANAKA, SH., 1931: Jour. Fac. Sci. Imp. Univ., Tôkyô. Sect. 4, III, (1), pp. 1-90.

the tropical elements. In 1933, L. S. BERG[5] studies the freshwater fishes of the pacific slope of Northern Asia and extends the view of the zoogeographical divisions of the Japan. He divides Japan and its territories into two, Palaearctic Region and Oriental Region, and includes Hokkaidô into Maritime Province district and Honshû, Shikokû, and Kyushû into Japan proper district. In 1936, T. MORI[6] has studied on the distribution of freshwater fishes in eastern Asia and extended his discussion to the distributions in Japan. He recognized the Palaearctic Region including three sub-regions Siberian sub-region, Chinese sub-region and the Oriental Region including Indo-Chinese sub-region. He includes Hokkaidô into Hokkaidô district of Siberian sub-region and Honshû, Shikokû and Kyushû into Honshû district of Chinese sub-region. H. KOBAYASHI[7] indicates the demarcation of northern element and of the southern element of the freshwater fishes may exists on the water shade between the coasts of the Pacific and Sea of Japan, located from the River Kozu, Shimane Prefecture and the River Tone, Ibaraki Prefecture. K. OGAWA[8] has studied the freshwater fishes of Kagoshima Prefecture and discussed on the geographical distribution of freshwater fishes of Japan. He describes that the demarcation line of Palaearctic and Oriental Regions must be lined on the Ôsumi Strait. Y. OKADA and M. NAKAMURA[9], 1948 study the geographical distribution of freshwater fishes of Japan and comment the divisions of the distributional area. They indicate the Japanese islands may be divided into five sections, according to their characteristic occurrences. 1). Hokkaidô 2), Tohokû 3). Central Honshû 4). Southwest Honshû 5). Shikokû and Kyushû. Furthermore they describe the peculialities of each section by taking many examples of the existence of endemic species in each section. H. AOYAGI[10] discusses the phylogenetical point of freshwater fishes of Japan in his book titled on "General Notes on the freshwater Fishes of the Japanese Archipelago" published in 1957. The most of the element of freshwater fishes distributed in Japan and adjacent islands is consisting of the continental forms originated from the eastern Asia, far north of Yantse River and North Pacific forms which originated from the coastal region of North Pacific, extending to Kamtchatka through Northern America, Canada and Alaska. The other element is the Indo-Chinese forms comming from the South China, Philippines and East Indies to the coast of South Pacific and Indian Ocean.

According to the general distribution of freshwater fishes of Japan and its vicinity, he proposes to divide the area into following sections.

A. Palaearctic Region
- I. Siberian Sub-region
  - 1. Sakhalin Section 2. Hokkaidô Section 3. Kurile Island Section
- II. Chinese Sub-region
  - 4. Hoshû Section
    - i. Tôhoku Sub-section. ii. Southwestern Sub-section. iii. Kuroshio Subsection.

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5) BERG, L. S., 1933: Proc. Fifth Pac. Sci. Congr. Canada, V, pp. 3791-3793.
6) MORI, T,. 1936: Studies on the Geographical Distribution of Freshwater Fishes in Eastern Asia, pp. 1-88.
7) KOBAYASHI, H., 1935: Nihon Tansuigyorui narabini sono Kiseityû, pp. 1-148.
8) OGAWA, K., 1937: Hiroshima Hakubutsu Gakkaishi, (5), pp. 11-27.
9) OKADA, Y. and NAKAMURA, M. 1948: Proc. Biogeo. Soc. Japan, (1), pp. 36-37.

B. Oriental Region
- III. Indochinese Sub-region
  - 5. Ryukyu Section
    - i. Satsunan Islands sub-section. ii. Okinawa and Sakishima sub-section.
  - 6. Formosa Section

b. Geographical Distribution of Freshwater Fishes of Japan

The Japanese terrestrial and aquatic fauna is rather complex and interesting, since Japan extends northward to Hokkaidô and southward to Amamioshima (from 25°.5 to 45°5 N. Lat.). As to the distribution of freshwater fishes, the general relations are nearly the same as of terrestrial animals.

From a distributional standpoint, Japan may be apportioned into Palaearctic and Oriental Regions. Hokkaidô is included in the Siberian Sub-region of the Palaearctic Region, while Honshû, Shikokû, Kyushû are parts of Manchurian Sub-region. Amamioshima belongs to the Indo-Chinese Sub-region of the Oriental Region.

So far as the studies of the freshwater fishes in Japan are concerned, 127 species and subspecies are found in the rivers, lakes and their tributaries, and are included under 27 families and 76 genera.

Of these species, 10 species and 2 subspecies show Oriental affinity while 15 species and 3 subspecies are of Palaearctic relations, and 22 species 5 subspecies are peculiar to the Japanese Fauna.

Table I. The distribution of the families of freshwater fishes in Japan and adjacent territories

Localities / Families	Malay Peninsula	South Asia	Europe	Central Asia	North America	South China	North China	Japan	Manchuria	Korea	Formosa
Petromyzontidae	−	−	+	+	+	−	−	+	+	+	−
Acipenseridae	−	−	+	+	+	−	+	+	+	+	−
**Chanidae*	+	+	−	−	−	−	−	+	−	−	+
Clupeidae	+	+	−	+	+	+	+	+	−	−	+
Engraulidae	−	+	−	−	+	+	+	+	−	+	+
Salmonidae	−	−	+	+	+		+	+	+	+	+
Plecoglossidae	−	−	−	−	−	+	−	+	−	+	+
Osmeridae	−	−	−	−	−	−	−	+	+	+	−
Salangidae	−	−	+	−	−	+	+	+	+	+	+
Cyprinodontidae	+	+	+	−	+	+	+	+	+	+	+
Siluridae	+	+	+	+	+	+	+	+	+	+	+
Bagridae	−	+	+	+	−	+	+	+	+	+	+
Cyprinidae	+	+	+	+	+	+	+	+	+	+	+
Cobitidae	+	+	+	−	−	+	+	+	+	+	+
Flutidae	+	+	+	+	−	+	+	+	+	+	+
Anguillidae	+	+	+	+	+	+	+	+	+	+	+
Gasterosteidae	−	−	+	+	+	+	+	+	+	+	[illegible]
Hemirhamphidae	−	−	−	−	−	+	+	+	−	+	−
Mugilidae	+	+	+	−	+	+	+	+	−	+	+
**Ophicephalidae*	+	+	+	−	−	+	+	+	+	+	+
**Anabantidae*	−	−	−	−	−	+	+	+	−	+	+
Kuhlidae	+	+	+	−	−	+	+	+	−	+	+
**Centrarchidae*	−	−	−	−	+	−	−	+	−	−	−
Serranidae	+	−	−	+	+	−	−	+	−	−	−
Cottidae	−	−	+	+	+	−	+	+	+	+	−
Gobiidae	+	+	+	+	+	+	+	+	−	+	+
Pleuronectidae	+	−	−	−	+	−	+	+	+	+	−

* indrouced

As to the demarcation of the freshwater distribution in Japan, we may recognize the "BLAKISTON Line" between Hokkaidô and Honshû (Tsugaru Strait) as for Mammalia, Aves and Amphibia. The "BLAKISTON Line" shows the demarcation between Manchurian and Siberian Sub-regions. We may also recognize the "WATASE' Line" lying between Amamioshima and Yakushima and Tanegashima, like that between the Indo-Chinese Sub-region of the Oriental Region and the Manchurian Sub-region the Palaearctic Region.

As our knowledge of the distribution of species is nearly complete, it may be well to note the known distribution of the families, genera and species of freshwater fishes in Japan, for the purpose of determining the derivation of the faunas, their relationships, and then, as far as possible, the zoogeographical interrelationships of the islands within Japan, and the relation of Japan to its adjacent territories,

The distribution of the families of freshwater fishes represented in the Oriental and Palaearctic Regions allocates 27 families in Japan, 4 families of which are introduced from Formosa, Korea and the United States of America. Plecoglossidae appear to be confined in Japan.

From the known distribution of freshwater fishes, we may divide Japan into three groups.

1. Hokkaidô 2. Honshû, Shikokû, Kyushû 3. Amamiôshima

Table II. The distribution of the families freshwater fishes in Japan

Families \ Localities	Sakhalin	Hokkaidô	Honshû	Shikoku	Kyushû	North Korea	South Korea	Amamioshima	Okinawa Isl.	Formosa
Petromyzontidae	+	+	+	+	+	+	+	–	–	–
Acipenseridae	+	+	+	–	+	+?	+	–	–	–
**Chanidae*	–	–	+*	–	–	–	+	–	–	+
Clupeidae	–	+	+	+	+	–	+	+	+	+
Engraulidae	–	–	+		+	+	+	–	–	High Mountain only
Salmonidae	+	+	+	+	+	+	+	–	–	+
Plecoglossidae	+	south +	+	+	+	+	+	+	+	North +
Osmeridae	+	+	+	–	+	+	+	–	–	–
Salangidae	+	+	+	+	north +	+	+	–	–	–
Cyprinodontidae	–	–	+	+	+	–?	+	+	+	+
Siluridae	+		+	+	+	+	+	+?	+	+
Bagridae	–	–	+	+	+	+	+	–	–	–
Cyprinidae	+	+	+	+	+	+	+	+	+	+
Cobitidae	–	+	+	+	+	+	+	+	+	+
Flutidae	–	–	+	+	+	+	+	+	+	+
Anguillidae	+	+	+	+	+	+	+	+	+	+
Gasterosteidae	+	+	+	+	+	+	+	–	–	–
Hemirhamphidae	–	–	+	+	+	+	+	+	–	–
Mugilidae	+	south +	+	+	+	+	+	+	+	+
**Ophicephalidae*	–	–	+*	+	+		+	+	+	+
**Anabantidae*	–	–	+*	+	+	+	+	+	+	+
Kuhliidae	–	–	+	+	+	–	+	+	+	+
Serranidae	–	+	+	+	+	+	+	+	+	+
**Centrarchidae*	–	–	+*	–	–	–	–	–	–	–
Cottidae	+	+	+	+	+	+	–	–	–	–
Gobiidae	+	+	+	+	+	+	+	+	+	+
Pleuronectidae	+	+	+	+	+	+	+	+	–	–

* introduced

Table III. The distribution of the genera of freshwater fishes in Japan and adjacent terriories

Genera \ Localities	Malay Peninsula	South Asia	Central Asia	Europe	North America	South China	North China	Japan	Manchuria	North Korea	South Korea	Okinawa Island	Formosa
Entosphenus	−	−	−	−	+	−	−	+	−	−	−	−	−
Lampetra	−	−	−	+	+	−	−	+	+	+	+	−	−
Acipenser	−	+	−	+	+	+	+	+	+	+	+	−	−
**Chanos*	+	+	−	−	−	+	−	+*	−	−	−	+	+
Clupea	+	+	−	+	+	+	−	+	−	+	+	−	−
Coilia	+	+	−	−	−	+	+	+	−	+	+	−	+
Oncnrhynchus	−	−	−	+	+	−	+	+	+	+	+	−	+
**Salmo*	−	−	−	+	+	−	+	+*	−	−	−	−	−
Hucho	−	−	−	−	−	−	+	+	+	−	−	−	−
Salvelinus	−	−	+	+	+	−	+	+	+	+	+	−	−
Plecoglossus	−	−	−	−	−	+	+	+	−	+	+	−	+
Osmerus	−	−	−	+	+	−	+	+	+	+	+	−	−
Hypomesus	−	−	−	−	+	−	+	+	+	+	+	−	−
Salangichthys	−	−	−	−	−	+	−	+	+	+	+	−	−
Aplocheilus	+	+	−	−	−	+	+	+	+	+	+	+	+
Parasilurus	−	−	−	−	−	+	+	+	+	+	+	−?	+
Pelteobagrus	−	−	−	−	−	+	+	+	+	+	+	−	−
Pseudobagrus	−	−	−	−	−	+	−	+	+	+	+	−	+
Coreobagrus	−	−	−	−	−	−	−	+	−	−	−	−	−
Liobagrus	−	+	+	−	−	+	+	+	+	+	+	−	+
Carassius	+?	+	+	+	+	+	+	+	+	+	+	+	+
Cyprinus	+	+	+	+	+	+	+	+	+	+	+	+	+
Rhodeus	−	+	−	+	−	+	+	+	+	+	+	−	+
Pseudoperilampus	−	−	−	−	−	+	+	+	−	+	+	−	−
Tanakia	−	−	−	−	−	−	−	+	−	−	−	−	−
Acheilognathus	−	−	−	−	−	+	+	+	+	+	+	−	+
Paracheilognathus	−	−	−	−	−	+	+	+	+	+	+	−	−
Pseudorasbora	−	−	−	−	−	+	+	+	+	+	+	−	+
Pungtungia	−	−	−	−	−	−	−	+	+	+	+	−	−
Biwia	−	−	−	−	−	−	−	+	−	−	−	−	−
Abbottina	−	−	−	−	−	+	+	+	+	+	+	−	−
Sarcocheilichthys	−	−	−	−	−	+	+	+	+	+	+	−	+
Aphyocypris	−	−	−	−	−	+	+	+	+	+	+	−	+
Phoxinus (*Moroco*)	−	+	−	+	+	+	+	+	+	+	+	−	−
Tribolodon	−	−	−	−	−	+	+	+	−	−	−	−	−
Gnathopogon	−	−	−	−	−	+	−	+	+	+	+	−	−
Pseudogobio	−	−	−	−	−	+	+	+	+	+	+	−	+
Hemigrammocypris	−	−	−	−	−	−	−	+	−	+	+	−	−
									south				
Zacco	−	+	−	−	−	+	+	+	+	+	+	−	+
Opsariichthys	−	+	−	−	−	+	+	+	+	+	+	−	+
Ischikauia	−	+	−	−	−	+	+	+	−	−	−	−	+
Hemibarbus	−	−	−	−	−	+	+	+	+	+	+	−	+
Misgurnus	−	−	−	−	−	+	+	+	+	+	+	+	+
Barbatula	−	−	+	−	−	+	+	+	+	+	+	−	−
Lefua	−	−	+	−	−	−	+	+	+	+	+	−	−
Cobitis	−	−	−	+	−	+	+	+	+	+	+	−	+
Hymenophysa	−	−	+	−	−	−	−	+	−	−	−	−	−
Fluta	+	+	−	−	−	+	+	+	+	+	+	+	+
Anguilla	+	+	−	+	+	+	+	+	−	+	+	+	+
Gasterosteus	−	−	+	+	+	+	+	+	+	+	+	−	−
Pungitius	−	−	+	+	+	+	+	+	+	+	+	−	−
Hemirhamphus	+	−	−	−	+	+	+	+	−	+	+	+	+
Mugil	+	+	−	+	+	+	+	+	−	+	+	+	+
**Channa*	+	+	−	−	−	+	+	+*	+	+	+	−	+
**Macropodus*	+	+	−	−	−	+	−?	+	+	+	+	−	+
Kuhlia	+	+	−	−	−	+	−	+	−	−	+	+	+
Micorpterus	−	−	−	−	+	−	−	+	−	−	−	+	+
Lateolabrax	+	−	−	−	−	+	+	+	+	+	+	+	+
Coreoperca	−	−	−	−	−	+	+	+	−	−	−	−	+
Ambassis	−	−	−	−	−	−	−	+	−	−	−	+	−

Table III. continued

Genera \ Localities	Malay Peninsula	South Asia	Central Asia	Europe	North America	South China	North China	Japan	Manchuria	North Korea	South Karea	Okinawa Island	Formosa
Trachidermus	–	–	–	–	–	–	–	+	+	+	+	–	–
Cottus	–	–	–	+	+	–	+	+	+	+	+	–	–
Eleotris	+	+	–	–	–	+	+	+	–	+	+	+	+
Odontobutis	+	–	–	–	–	+	–	+	–	+	+	–	–
Luciogobius	–	–	+	–	–	+	+	+	+	+	+	–	–
Gobius	+	+	–	+	+	+	+	+	–	–	+	–	–
Awaous	+	+?	–	–	–	–	–	+	–	–	–	+	+
Acanthogobius	–	–	–	–	–	+	+	+	–	+	+	+	+
Glossogobius	+	+	–	–	–	+	+	+	–	–	–	+	+
Chaenogobius	–	–	–	–	–	–	–	+	+	+	+	+	–
Rhinogobius	–	–	–	–	–	+	+	+	+	+	+	–	+
Tridentiger	–	–	–	–	–	+	+	+	+	+	+	+	–
Sicydium	+	+	–	–	–	+	–	+	–	+	+	+	–
Platichthys	–	–	–	–	+	–	–	+	+	+	–	–	–

Table IV. The distribution of the genera of freshwater fishes in Japan

Genera \ Localities	Sakhlin	Hokkaidô	Honshu	Shikoku	Kyushû	North Korea	South Korea	Amamioshima	Okinawa Isl.	Formosa
Entosphenus	–	+	+	–	–	–	–	–	–	–
Lampetra	+	+	+	+	+	+	+	–	–	–
Acipenser	+	+	+	–	+	–	+	–	–	–
**Chanos*	–	–	+*	–	–	–	–	–	+	+
Clupea	–	+	+	+	+	–	+	+	+	–
Coilia	–	–	+	+	+	–	+	–	–	+
Oncorhynchus	+	+	+	+	+	+	+	–	–	+
**Salmo*	–	–	+*	+*	+*	–	–	–	–	–
Hucho	+	+	north +	–	–	+	–	–	–	–
Salvelinus	+	+	+	–	–	+	–	–	–	–
Plecoglossus	–	south +	+	+	+	+	+	+	+	north +
Osmerus	+	+	–	–	–	+	+	–	–	–
Hypomesus	+	+	+	–	–	+	+	–	–	–
Salangichthys	+	+	+	+	+	+	+	–	–	–
Neosalanx	–	–	–	–	+	–	–	–	–	–
Salanx	–	–	–	–	+	+	–	–	–	–
Aplocheilus	–	–	+	+	+	+	+	+	+	+
Parasilurus	–	–	+	+	+	+	+	–	–	+
Pelteobagrus	–	–	+	+	+	+	+	–	–	–
Pseudobagrus	–	–	+	+	+	+	–	–	–	+
Coreobagrus	–	–	+	–?	–	+	–	–	–	–
Liobagrus	–	–	+	+	+	+	+	–	–	+
Carassius	+	+	+	+	+	+	+	+	+	+
Cyprinus	+*	+	+	+	+	+	+	+	+	+
Rhodeus	+	–	+	–?	+	+	+	–	–	+
Pseudoperilampus	–	–	+	–	–	+	+	–	–	–
Tanakia	–	–	+	–	+	–	–	–	–	–
Acheilognathus	–	–	+	+	+	+	+	–	–	+
Paracheilongnathus	–	–	+	+	+	+	+	–	–	–
Pseudorasbora	–	–	+	–	+	+	+	–	–	+
Pungtungia	–	–	+	–	+	+	+	–	–	–
Biwia	–	–	+	–	+	+	+	–	–	–
Abbottina	–	–	+	–	+	+	+	–	–	–
Sarcocheilichthys	–	–	+	–	+	+	+	–	–	+
Aphyocypris	–	–	+	–	+	+	+	–	–	+
Phoxinus	+	+	+	–	+	+	+	–	–	–

* introduced

Table IV. continued

Genera \ Localities	Sakha-lin	Hok-kaidô	Hon-shu	Shiko-ku	Kyu-shu	North Korea	South Korea	Ama-mio-shima	Oki-nawa Isl.	For-mosa
Tribolodon	+	+	+	+	+	+	+	–	–	–
Gnathopogon	–	–	+	+	+	–	–	–	–	–
Pseudogobio	–	–	+	?	+	+	+	–	–	+
Hemigrammocypris	–	–	+	–	+?	+	+	–	–	–
Zacco	–	–	+	+	+	+	+	–	–	+
Opsariichthys	–	–	+		+?	+	–	–	–	+
Ischikauia	–	–	+	–	–	–	–	–	–	+
Hemibarbus	–	–	+	–	–	+	+	–	–	+
Misgurnus	–	+	+	+	+	+	+	+	+	+
Barbatula	+	+	–	–	–	+	+	–	–	–
Lefua	–	+	–	–	–	–	–	–	–	–
Cobitis	+	–	+	+	+	–	–	–	–	+
Hymenophysa	–	–	+	–	–	–	–	–	–	–
Fluta	–	–	+	+	+	–?	+	+	+	+
Anguilla	–	+	+	+	+	+	+	+	+	+
Gasterosteus	+	+	+	+	+	+	+	–	–	–
Pungitius	+	+	+	–	+	+	+	–	–	–
Hemirhamphus	–	–	+	+	+	+	+	–?	–	–
Mugil	–	–	+	+	+		+	+	–	+
**Channa*	–	–	+*	+*	+*	+	+	–	–	+
**Macropodus*	–	–	+*	+*	+*	+	+	–	–	+
Kuhlia	–	–	+	+	+	–	+	+	+	+
Lateolabrax	–	+	+	+	+	+	+	–	–	+
**Micropterus*	–	–	+*	–	–	–	–	–	–	–
Coreoperca	–	–	+	–	+?	+?	+	–	–	+
Ambassis	–	–	–	–	–	–	–	–	+	–
Trachidermus	–	–	–	–	+	+	+	–	–	–
Cottus	+	+	+	+	+	+	+	–	–	–
Eleotris	–	–	+	+	+	+	+	–	–	+
Odontobutis	–	–	+	–	+	–	+	–	–?	–
Luciogobius	–	+	+	–	+	+	+	+	+	–
Gobius	–	–	+	–	+	–	+	+	+	+
Awaonus	–	–	–	–	–	–	–	+	–	–
Acanthogobius	–	+	+	+	+	+	+	+	–	+
Glossoogobius	+	–	+	+	+	–	–	–	+	+
Chaenogobius	+	+	+	+	+	+	+	+	+	–
Rhinogobius	–	–	+	+	+	–	–	–	–	+
Tridentiger	–	+	+	+	+	+	+	+	+	–
Sicydium	–	–	+	+	+	–	+	+	+	–
Platichthys	+	+	north +	–	–	+	+	+	–	–

* introduced

From table IV it will be observed that, 68 genera (5 genera were introduced) represented in Honshû, 38 genera, in Shikokû and 59 genera in Kyushû (3 genera are doubtful) exist in Japan. 24 genera of those exist in southern and 12 genera in central Asia. 57 genera are found in southern and northern Korea showing the intimate relation-ships which exists between these districts.

As indicated in the table IV, Sakhalin belongs to a different district because of the absence of many genera found in Hokkaidô and Honshû. Hokkaidô is also separable from Honshû by the absence of many genera belong to Cyprinoid, Bagrid and Cobitoid families. Honshû, and Shikokû are somewhat different since the different genera occur in these districts. In Shikokû, freshwater fishes are rather less than in Kyushû. From these distributions of many genera, Japan may be divisible into the following five distributional sections.

1. Hokkaidô 2. Honshû……subdivided into Northern Honshû, Central Honshû and Southwest Honshû. 3. Shikokû 4. Kyushû 5. Amamioshima.

The peculiarities of each section are summarized as follows.

II. The distributional limits of genera of Japanese freshwater fish.

The distribution limits in Japan of the various genera as common *Lampetra*, *Oncorhynchus*, *Plecoglossus*, *Hypomesus*, *Aplocheilus*, *Carassius*, *Cyprinus*, *Acheilognathus*, *Tribolodon*, *Gnathopogon*, *Zacco*, *Misgurnus*, *Cobitis*, *Anguilla*, *Gasterosteus*, *Cottus*, *Eleotris* and *Gobius* are not only important from the standpoint of the Zoogeography of Japan, but also indicating the important facts of the distribution of these genera in eastern Asia.

Table V. Freshwater fish distribution in Hokkaidô and adjacent localities.

Species \ Localities	Sakhalin	Kuril Islahds	Hokkaidô	Honshû			Shikokû	Kyushû
				North	Middle	South		
Entosphemus tridentatus	−	−	+	−	+	−	−	−
Lampetra planeri	+	−	+	+	+	+	+	+
Oncorhynchus nerka	+	+	+	−	−	−	−	−
O. gorbuscha	+	+	+	−	−	−	−	−
O. tchawytcha	+	?	+	−	−	−	−	−
O. keta	+	+	+	+	−	−	−	−
O. rhodurus	−	−	−	−	+	+	+	+
O. masou	+	−	+	+	+	+	+	+
O. kisutch	+	+	+	+	−	−	−	−
Salvelinus leucomaenis	+	+	+	+	−	−	−	−
S. malma	+	+	+	−	−	−	−	−
Plecoglossus altivelis	−	−	+	+	+	+	+	+
Osmerus dentex	−	+	+	−	−	−	−	−
Hypomesus olidus	+ ?	?	+	+	+	+	− ?	− ?
Spirinchus lanceolatus	−	−	+	−	−	−	−	−
Hucho perryi	+	+	+	+	−	−	−	−
Mallotus catervarius	−	−	+	−	−	−	−	−
Platichthys stellatus	+	+	+	+	−	−	−	−
Salangichthys microdon	+	− ?	+	+	+	+	+	+
Acipenser mikadoi	−	−	+	+	−	−	−	−
Hucho perryi	+	+	+	+	−	−	−	−
Phoxinus percnurus	+	+	+	−	−	−	−	−
Tribolodon hakuensis	+	+	+	+	+	+	+	+
T. brandti	+	−	+	+	−	−	−	−
Carassius auratus	+	−	+	+	+	+	+	+
Cyprinus carpio	−	−	+	+	+	+	+	+
Misgurnus anguillicaudatus	−	−	+	+	+	+	+	+
Barbatula toni	+	−	+	−	−	−	−	−
Lefua nikkonis	−	−	+	−	−	−	−	−
Gasterosteus aculeatus aculeatus	−	+	+	+	+	+	−	−
Pungitius pungitius	+	+	+	+	+	+	+	+
P. tymensis	+	−	+	−	−	−	−	−
P. sinensis	+	−	+	+	+	+	−	−
Cottus nozawae	−	−	+	−	−	−	−	−
Lateolabrax japonicus	−	−	+	+	+	+	+	+
Chaenogobius annularis annularis	+	+	+	+	+	+	+	+
Tridentiger obscurus	−	−	+	+	+	+	+	+
Luciogobius guttatus	−	−	+	+	+	+	+	+

1. Hokkaidô Section: Most of the fish of Hokkaidô section belong to the Palaearctic elements including Siberian and North Pacific forms. Hokkaidô is quite rich in Salmonoid members and somewhat scarce in Cyrinoid, Cobitoid Poecilid fishes. *Cyprinus*

carpio, *Carassius auratus*, *Lampetra planeri*, *Oncorhynchus rhodurus*, *Salvelinus leucomaenis*, *Plecoglossus altivelis*, *Phoxinus steindacherni*, *Misgurnus anguillicaudatus*, *Gasterosteus aculeata aculeata*, *Pungitius sinensis*, *Cottus kazika*, and *Chaenogobius annularis* are commonly distributed throughout both Honshû and Hokkaidô. *Cottus pollux* was once recorded from Otaru (mentioned *C. otarranai* in original) and has never been rediscovered in Hokkaidô. From this reason, the author changes the scientific name of *Cottus pollux* into *Cottus japonicus*. *Cottus nozawae* (probably synonymous to *C. reini*) seems to be peculiar to Hokkaidô but very closely allied to *C. amblystomopsis* found in Siberia and southern Sakhalin. *Barbatula toni oreas* seems to be peculiar to Hokkaidô showing a very slight modification from *B. toni toni* distributed in Sibera and Sakhalin. *Lefua nikkonis* resembles *Lefua castata* in the Asiatic Continent and *Lefua echigonia* in southern Honshû while it is considered a distinct peculiar species of Hokkaidô. *Moroco percnurus sachaliensis* found in Hokkaidô and Sakhalin resembles *M. percnurus percnurus* more than *Moroco stenidachneri* in Honshû found in Siberia and northern Korea.

From these facts, the pure freshwater fish fauna of Hokkaidô is evidently separated from that of Honshû, containing the northern forms related to the species of the Siberian subregion.

II. Honshû Section: Honshû has more peculiar species and Chinese forms than Hokkaidô proving a long isolation from the Asiatic continent. According to D. S. JORDAN, SH. TANAKA, T. KOBAYASHI, and M. OSHIMA, Honshû is divided into three geographical sections having peculiar species in each area, but the demarcation of each area is still left undetermined and open to discussion.

According to our view Honshû may be divided into three sub-sections.

a). Northern Honshû sub-section: This sub-section is also called "Tohokû Sub-section" and has its southern limit at the northern Hakone mountain region on the Pacific coast while on the coast on the Sea of Japan, it is north of the Shinano River of Niigata Prefecture. The characteristic genera are *Lampetra*, *Oncorhynchus*, *Salvelinus*, *Plecoglossus*, *Salangichthys*, *Anguilla*, *Parasilurus*, *Pelteobagrus*, *Aplocheilus*, *Pseudobagrus*, *Cottus*, *Acheilognathus*, *Pseudoperilampus*, *Pseudorasbora*, *Zacco*, *Cobitis*, *Gobius*, *Tridentiger* and *Chaenogobius*. The peculiar species also found in this section are as follows: *Pseudoperilampus typus*, *Acheilognathus moriokae*, *Pseudobagrus aurantiacus*, *Pseudorasbora parva pumila* and *Tanakia tanago*. In general, the main species belong to the Chinese forms partly including Indo-Chinese forms and Siberian and Northern Pacific forms.

b). Middle Honshû sub-section: This sub-section occupies an area including the south of the middle Honshû sub-section up to Biwa Lake and the Yodo River. The peculiar species are found abundantly in Lake Biwa and its vicinity as follows: *Acheilognathus longipinnis*, *Acheilognathus cyanostigma*, *Gnathopogon biwae*, *Gnathopogon japonicus*, *Biwia zezera*, *Ischikauia steenackeri*, *Opsariichthys uncirostris*, *Hymenophysa curta* and *Sarcocheilichthys variegatus*. *Pseudorasbora parva*, *Pseudogobio esocinus*, *Phoxinus steindachneri*, *Zacco platypus*, *Zacco temmincki*, *Cobitis taenia biwae* are rather widely distributed in this sub-section. *Hemigrammocypris rasborella*, *Rhodeus ocellatus*, *Biwia zezera*, *Pungtungia herzi*, *Abbottina rivularis*, *Opsariichthys uncirostris*, *Ischikauia steenackeri*, *Hemibarbus longirostris*, *Hemigrammocypris rasborella*, *Hymenophysa curta* and *Coreoperca kawamebari* are quite peculiar in the area of this sub-section which is surrounded by the northwestern Kyushû and Seto In-

land slope. They are not extended from north of Biwa Lake and the River Yodo basin, nor beyond Ibuki and Suzuka mountain range far east. Only *Hemigrammocypris rasborella*

Table VI. Freshwater fish distribution in Honshû and adjacent localities

Species \ Localities	Hokkaidô	Honshû			Shikoku	Kyushû
		North	Middle	South		
Entosphenus japonicus	+	+	+	−	−	−
Lampetra planneri	+	+	+	+	+	+
Acipenser kikuchii	−	−	−	+	−	−
A. multisculatus	−	+	−	−	−	−
A. mikadoi	−	+	−	−	−	−
Oncorhynchus keta	+	+	+	−	−	−
O. rhodurus	−	−	+	+	+	+
Salvelinus leucomaenis	+	+	+	−	−	−
S. pluvius	−	−	+	+	+	+
Hypomesus olidus	+	+	+	+	−	−
H. japonicus	+	+	−	+	−	−
Plecoglossus altivelis	+	+	+	+	+	+
Salangichthys microdon	+	+	+	+	+	+
Platichthys stellatus	+	+	+	+	−	−
Carassius auratus	+	+	+	+	+	+
Cyprinus carpio	+	+	+	+	+	+
Rhodeus ocellatus	−	−	+	+	+	+
Pseudoperilampus typus	−	+	+	+	−	−
Acheilognathus lanceolatus	−	+	+	+	+	+
A. tabira	−	+	+	+	+	+
A. rhombea	−	−	−	+	?	+
A. cyanostigma	−	−	+	+	+	+
A. longipinnis	−	−	−	+	−	+
Tanakia oryzae	−	−	−	+	−	+
Pseudorasbora parva	−	+	+	+	+	+
Biwia zezera	−	−	−	+	−	+
Pungtungia herzi	−	−	−	+	−	+
Abbottina rivularis	−	−	−	+	−	+
Sarcocheilichthys variegatus	−	−	−	+	+	+
Phoxinus steincachneri	−	−	+	+	+	+
Gnathopogon elongatus elongatus	−	−	+	+	+	+
Hemigrammocypris rasborella	−	− Shinano River	+	+	−	+
Zacco platypus	−	−	+	+	+	+
Z. temmincki	−	−	+	+	+	+
Opsariichthys uncirostris	−	−	+ Biwa L.	−	−	−
Ischikauia steenackeri	−	−	+ Biwa L.	−	−	−
Hemibarbus longirostris	−	−	+	+	+	+
H. barbus	−	+	+	+	+	+
Tribolodon hakuensis	−	+	+	+	+	+
T. brandti	+	+	−	−	−	−
Lefua echigonia	−	+	+	+	−	−
Misgurnus anguillicaudatus	−	+	+	+	+	+
Gasterosteus aculeatus aculeatus	+	+	+	+	+	+
Pungitius pungitius	+	+	+	+	+	+
P. sinensis	+	+	+	+	−	−
Cottus japonicus	−	+	+	+	+	+
C. kazika	−	−	+	+	+?	+
Cobitis biwae	−	+	+	+	+	+
C. taenia striata	−	−	−	−	+	+
C. delicata	−	−	+	−	−	−
Hymenophysa curta	−	−	+	−	−	−
Coreoperca kawamebari	−	−	+	+	?	+
Odontobutis obscura	−	+	+	+	+	+
Chaenogobius macrognathus	−	+	−	−	−	−

Table VI. continued

Localities / Species	Hokkaidô	Honshû North	Honshû Middle	Honshû South	Shikoku	Kyushû
C. annularis annularis	+	+	+	+	+	+
Acanthogobius lactipes	+	+	+	+	+	+
A. flavimanus	−	+	+	+	+	+
Tridentiger obscura	+	+	+	+	+	+
T. trignocephalus	+	+	+	+	?	?
Eleotris oxycephalus	−	−	+	+	+	+
Gobius pflaumi	−	+	+	+	+	+
G. nebulosus	−	+	+	+	+	+
G. giurius	−	+	+	+	+	+
G. similis	+	+	+	+	+	+
G. abei	−	−	−	+	?	?
Glossogobius brunneus	−	−	+	+	+	+
Sicydium japonicum	−	+	+	+	−	−
Luciogobius guttatus	−	+	+	+	+	+
Hemirhamphus kurumeus	−	+	+	+	+	+

Sarcocheilichthys variegatus and *Gnathopogon elongatus japonicus* are distributed far north of Honshû,

In general, this sub-section has a predominant freshwater fish fauna, composing of many cyprinoid species of Chinese element and scarce of the Siberian and north Pacific elements.

c). Southwestern Honshû sub-section: This sub-section occupies an area from the South of Biwa Lake to the southern end of Honshû. The peculiar genera in this sub-esction are *Fluta*, *Sicydium* and *Eleotris*. The endemic species are *Gnathopogon gracilis*, *Hemibarbus longirostris* and *Coreoperca kawamebari* and some of them are related to the species distributed in northern Kyushû.

The three sub-sections above mentioned are not yet absolutely confirmed and need further investigations. However, it is clear that the third Honshû section has richer and more peculiar faunae than the other sections, exhibiting an older isolation and complexity. Common and allied species found both in the Chinese continent and Japan are distributed mostly in the third and fourth sections. From these facts, it is evident that Hokkaidô is mostly occupied by the Siberian species, while Honshû partly by the Chinese species.

III. Shikokû Section: As to the freshwater fish distribution, this district seems to be the same as the south-western Honshû sub-section and the condition is rather poor, partly due to insufficient investigations and poor freshwater environments, lacking larger lakes and rivers.

IV. Kyushû Section: The freshwater fish-fauna in this section is nearly the same as the Southwestern Honshû sub-section with an exception of *Acanthorhodeus atremius*, which seems to be allied to *Pseudoperotampus uyekii* and *P. notatus* in the Asiatic continent. On the Pacific coast of Kyushû, *Zacco platypus*, *Cobitis biwae* and *Cottus pollux*, very common fish in Honshû, are absent. It is strange that *Pseudobagrus aurantiacus*, distributed in this district, is found elsewhere only in the north of the Kantô district (included into the Northern Honshû sub-section). It seems that the distribution of freshwater fishes in the eastern, western, western and southern sub-sections of Kyushû are

somewhat different in each section, especially, the southern district of which has a very poor fauna, same as in the Pacific coast of Shikokû.

V. Amamiôshima Section: The freshwater fish fauna of this island is very little known up to the present. Further investigations are required for it in this section. Perhaps the oriental characteristic of the fauna may be more dominant than the palaearctic elements.

In general, the result of our investigations is in accordance with mammalian, avian, and cold blooded vertebrates distributions, and the BLAKISTON Line which runs between Hokkaidô and Honshû may well be accepted.

Interesting facts in relation to the freshwater fish fauna in Japan are emphasized by the fact that it is generally poor or sometimes non-existent in peninsulas. Such conditions prevail among many peninsulas of Aomori, Chiba, Kanagawa and Shizuoka Prefectures as well as the Pacific coast of Shikokû and the southern part of Kyûshû. In these areas species occurring in the neighbouring areas are absent.

One cause which results in the present day distribution is artificial transplantation. Recently the authorities of the Fisheries Bureau of Japan are undertaking transplantations of fish into various lakes and rivers and the former distribution is thus artificially disturbed. In the Kantô district *Gnathopogon elongatus elongatus* was introduced with *Abbottina rivularis*. By the transplantation of freshwater bivalve *Cristaria plicata* from Kasumigaura lake, Ibaraki Prefecture, was accidentally introduced into Suwa Lake, Nagano Prefecture. *Pseudoperilampus typus* from the latter district was recently found near Fukude-chô, Iwate-gun, Shizuoka Prefecture by the Tenryû River system. Furthermore, *Gambusia affinis*, *Channa argus*, *C. maculata* and *Macropodus chinensis* have been introduced from outside of Japan and now are properly established.

We may conclude that the general aspect of the freshwater fish found in Japan are closely related to those in the Siberian and Chinese subregions, the fact of which was already emphasized by T. MORI (1936). However, the existence of some species which evolved into quite distinct types in Japan indicates a long geographical isolation of the Japanese islands from the Asiatic mainland.

Table VII. Freshwater fishes of Japan and adjacent territories

Localities / Species	Sakhalin	Hokkaidô	Honshû North	Honshû Middle	Honshû South	Shikoku	Kyushû	South Korea	North Korea	Amamioshima	Okinawa	Formosa
Entosphenus tridentatus	−	+	+	−	−	−	−	−	−	−	−	−
Ent. japonicus	−	+?	+	+	−	−	−	−	−	−	−	−
Lampetra planeri	−	+	+	+	+	+	+	+	−	−	−	−
Acipenser kikuchii	−	−	+	−	−	−	−	−	−	−	−	−
A. mikadoi	−	+	+	−	−	−	−	+	−	−	−	−
**Chanos chanos*	−	−	−	+*	−	−	−	−	−	−	+	+
Clupea pallasii	+	−?	+	+	−	−	−	−	−	−	−	−
Coilia mystus	−	−	−	−	−	−	+	+	−	−	−	−
C. ectenes	−	−	−	−	−	−	+	+	−	−	−	−
Oncorhynchus nerka	+	+	+	−	−	−	−	−	+	−	−	−
O. gorbuscha	+	+	+	−	−	−	−	−	+	−	−	−
O. tschawytscha	−	+	−	−	−	−	−	−	−	−	−	−
O. keta	−	+	+	−	−	−	−	−	+	−	−	−
O. rhodurus	−	−	+	+	+	−	−	−	−	−	−	−
O. masou	+	+	+	+	+	−	+	−	+	−	−	−

Table VII. continued

Localities / Species	Sakha-lin	Hok-kaidô	Honshû North	Honshû Mid-dle	Honshû South	Shi-koku	Kyu-shû	South Korea	North Korea	Ama-mio-shima	Oki-nawa	For-mosa
O. kisutch	+	+	–	–	–	–	–	–	–	–	–	–
**Salmo irideus*	–	+*	+*	+*	+*	–	–	–	–	–	–	–
			north									
Hucho perryi	+	+	+	–	–	–	–	–	–	–	–	–
			north									
Salvelinus leucomaenis	+	+	+	+	+	–	–	–	–	–	–	–
**S. fontinalis*	–	–	+*	+*	+*	–	–	–	–	–	–	–
S. pluvius	–	–	+	+	+	–	–	–	–	–	–	–
S. malma	+	+	–	–	–	–	–	–	+	–	–	–
	–	south										north
Plecoglossus altivelis	–	+	+	+	+	+	+	+	+	+	+	+
Spirinchus lanceolatus	+	+	–	–	–	–	–	–	–	–	–	–
Hypomesus olidus	+	+	+	+	+	–	–	+	+	–	–	–
Hy. japonicus		+	–	–	–	–	–	–	+	–	–	–
	south											
Salangichthys microdon	+	+	+	+	+	–	+	+	+	–	–	–
S. ishikawae	–	–	+	+	+	–	–	–	–	–	–	–
Neosalanx reganius	–	–	–	–	–	–	+	–	–	–	–	–
Salanx ariakensis	–	–	–	–	–	–	+	–	+	–	–	–
Aplocheilus latipes	–	–	+	+	+	+	+	+	–	+	+	+
**Gambusia affinis*	–	–	–	+*	+*	+*	+*	–	–	+*	+*	+*
Parasilurus asotus	–	–?	+	+	+	+	+	–	–	–	–	–
Pseudobagrus aurantiacus	–	–	+	+	+	–	+	–	–	–	–	–
P. nudiceps	–	–	–	+	+	+	+	–	–	–	–	–
Coreobagrus ichikawai	–	–	–	+	+?	–	–	–	–	–	–	–
Liobagrus reini	–	–	+	+	+	+	+?	–	–	–	–	–
Carassius auratus	–	+	+	+	+	+	+	+	+	–	+	–
Cyprinus carpio	–	+	+	+	+	+	+	+	+	+	+	+
Rhodeus ocellatus	–	–	–	+	+	–?	+	+	+	–	–	+
Pseudoperilampus typus	–	–	+	+?	–	–	–	–	–	–	–	–
Tanakia oryzae	–	–	–	–	–	–	+ Naga-saki	–	–	–	–	–
			Tokyo									
T. tanago	–	–	–	–	–	–	–	–	–	–	–	–
			Chiba									
T. miobuta	–	–	+	–	–	–	–	–	–	–	–	–
Ach. lanceolata	–	–	+	+	+	+	+	–	+	–	–	–
				Biwa L.								
Ach. lanceolata limbata	–	–	–	+	+	+	+	+	+	–	–	–
Ach. l. morioka	–	–	+	–	–	–	–	–	–	–	–	–
Ach. tabira	–	–	+	+	+	–?	+	+	–	–	–	–
Ach. rhombea	–	–	–	+	+	–	+	+	+	–	–	–
Ach. cyanostigma	–	–	+	+	+	–	+	–	–	–	–	–
Ach. longipinnis	–	–	–	+	+	–	–	–	–	–	–	–
Pseudorasbora parva	–	–	+	+	+	–	+	–	+	–	–	+
P. parva pumila	–	–	+	+	–	–	–	–	–	–	–	–
Biwia zezera	–	–	–	+	+	–	+	–	–	–	–	–
Pungtungia herzi	–	–	–	+	+	–?	+	+	+	–	–	–
Abbottina rivularis	–	–	–	+	+	–	+	+	+	–	–	–
Sarcocheilichthys variegatus	–	–	–	+	+	+	+	–	–	–	–	–
Aphyocypris chinensis	–	–	–	–	–	–	+	+	+	–	–	–
Phoxinus percnurus	+	+	–	–	–	–	–	–	+	–	–	–
Ph. steindachneri	–	–	+	+	+	+	+	–	–	–	–	–
Tribolodon hakuensis	–	+	+	+	+	+	+	+	+	–	–	–
T. hakuensis ezoe	–	+	–	–	–	–	–	–	–	–	–	–
T. brandti	+	+	+	–	–	–	–	+	+	–	–	–
Gnathopogon elongatus	–	–	–	+	+	+	+	–	–	–	–	–
G. elongatus caerulescens	–	–	–	+	+	–	–	–	–	–	–	–

Table VII. continued

Species \ Localities	Sakhalin	Hokkaidô	Honshû North	Honshû Middle	Honshû South	Shikoku	Kyushû	South Korea	North Korea	Amamioshima	Okinawa	Formosa
G. elongatus japonicus	–	–	–	Biwa L. +	+	+	+?	–	–	–	–	–
G. elongatus gracilis	–	–	–	+	–?	–?	+	–	–	–	–	–
Pseudogobio esocinus	–	–	Kitakami R. +	+	–	–?	+	+	+	–	–	–
Hemigrammocypris rasborella	–	–	–	+	+	–	+	+	+	–	–	–
Zacco platypus	–	–	Shinano River –	+	+	+	+	+	+	–	–	+
Z. temmincki	–	–	–	+	+	+	+	+	+	–	–	–
Opsarichthys uncirostris	–	–	–	Biwa L. +	–	–	–	–	–	–	–	–
Ischikauia steenackeri	–	–	–	Biwa L. +	–	–	–	–	–	–	–	–
Hemibarbus longirostris	–	–	–	+	+	–	–	+	+	–	–	–
H. barbus	–	–	–	+	+	+	+	–	–	–	–	–
Misgurnus anguilicaudatus	–	–	–	+	+	+	+	–	+	–	–	–
Barbatula toni	–	–	–	–	–	–	–	–	+	–	–	–
Lefua nikkonis	–	+	–	–	|	–	–	–	–	–	–	–
L. echigonia	–	–	+	+	+	–	–	–	–	–	–	–
Cobitis biwae	–	–	+	+	+	+	+	–	–	–	–	–
C. taenia	–	–	–	–	–	–	+	–	–	–	–	–
C. taenia striata	–	–	–	+	+	+	+	–	–	–	–	–
C. delicata	–	–	–	Kiso R. +	–	–	–	–	–	–	–	–
Hymenophysa curta	–	–	–	+	+	–	–	–	–	–	–	–
Fluta alba	–	–	–	+	+	+	+	–?	–	+	+	+
Anguilla japonica	–	South +	+	+	+	+	+	+	+?	+	+	+
An. mauritiana	–	–	Chiba +	+	+	+	+	+	–	+	+	+
Gasteroteus aculeatus aculeatus	+	+	+	+	+	+	Oita +	+?	+	–	–	–
G. aculeatus microcephalus	–	–	–	+	–	–	–	+	–	–	–	–
Pungitius pungitius	+	+	+	+	–	–	–	–	+	–	–	–
P. tymensis	+	+	–	–	–	–	–	–	+	–	–	–
P. sinensis	+	+	+	+	+	–	–	–	+	–	–	–
Hemirhamphus kurumeus	–	–	–	+	+	–	+	+	–	–	–	–
Mugil cephalus	–	South +	+	+	+	+	+	+	+	+	+	+
**Channa tadiana*	–	–	+*	+*	+*	–	–	–	–	–	–	+
**Macropodus opercularis*	–	–	–*	+*	–*	–	–	–	–	–	+	+
**M. chinensis*	–	–	+*	+*	+*	+*	–	+	–	–	–	–
Kuhlia marginata	–	–	–	+	+	+?	+	–	–	+	+	+
**Micropterus salmoides*	–	–	–	+	–	–	–	–	–	–	–	–
Lateolabrax japonicus	–	South +	+	+	+	+	+	–	–	+	–?	–
Coreoperca kawamebari	–	–	+	+	+	–	+	+	–	–	–	–
Trachidermus faciatus	–	–	–	–	–	–	+	+	+	–	–	–
Cottus japonicus	–	+	+	+	+	+	+	–	–	–	–	–
C. nozawae	–	+	–	–	–	–	–	–	–	–	–	–
C. hangyonensis	–	+	–	–	–	–	–	–	–	–	–	–
Eleotris oxycephala	–	–	–	+	+	+	+	–	–	–	–	–
E. fusca	–	–	–	–	–	–	–	–	–	+	+	+
Odontobutis obscura	–	–	+	+	+	+	–?	+	–	–	–	–
Luciogobius guttatus	–	Otaru +	+	+	+	+	+	+	–	+	+	+
Heteroplopomus barbatus	–	–	–	–	+	–	+	–	–	–	–	–

Table VII. continued

Species \ Localities	Sakha-lin	Hok-kaidô	Honshû North	Honshû Mi-ddle	Honshû South	Shi-koku	Kyu-shû	South Korea	North Korea	Ama-mio-shima	Oki-nawa	For-mosa
Gobius pflaumi	−	−	Onaga-wa +	+	+	+	+	+	−	+	+	+
G. nebulosus	−	−	−	−	−	−	−	−	−	+	+	+
G. giurinus	−	−	Tone R. +	+	+	+	+	+	−	+	+	+
G. similis	−	+	+	+	+	+	+	+	−	+	+?	−
G. abei	−	−	Araka-wa +	+	+	−	−	−	−	−	+	−
Awaous ocellaris	−	−	−	+	−	−	−	−	−	−	+	+
Acanthogobius lactipes	−	+	−	+	+	+?	+	+	−	−	−	−
Ac. flavimanus	−	−	−	+	+	+	+	+	−	−	−	−
Ac. hasta	−	−	−	−	−	−	+	+	−	−	−	+
Glossogbius brunneus	+?	−	−	+	+	+	+	−	−	−	−	+
G. giurus	−	−	−	−	−	−	−	−	−	−	+	+
Chaenogobius annularis	−	+	+	+	+	−	−	+	+	−	−	−
Ch. ann. urotaenia	+	+	+	+	+	+	+	+	+	+	−	−
Trigonocephalus obscurus	−	Ishikari R. +	+	+	+	+	+	+	−	+	+	−
T. trigonocephalus	−	−	+	+	+	−	+	+	+	−	−	−
Sicydium japonicum	−	−	Naka-gawa +	+	+	+	+	−	−	+	+	+
Platichthys stellatus	+	+	+	−	−	−	−	−	+	−	−	−

Summary

By the distribution of 127 species and subspecies of freshwater fishes, Japan may be divided into five geographical sections and three sub-sections Hokkaidô section, Honshû section (including sub-sections 1–3 Northern Honshû, Middle Honshû and Southern Honshû), Shikokû, Kyûshû and Amamiôshima. The characteristices of each section has been explained. The BLAKISTON Line which runs between Hokkaidô and Honshû is supported.

The Japanese fauna of freshwater fishes is closely related to those of the Siberian and Chinese subregions, but the distinctness of local types indicates a long geographical isolation of the islands.

The translocation of some fishes has disturbed the natural distribution in some districts.

Plate I

1. An eel long line "Unagi Hainawa" used in Lake Suwa, Nagano Prefecture.
2. An eel long line fishing in Lake Suwa, Nagano Prefecture.
3. An eel long line fishing at Kihara-mura, Inashiki-gun, Ibaraki Prefecture.
4. A cat fish long line used at Kihara-mura, Inashiki-gun, Ibaraki Prefecture.
5. An eel long line fishing in Lake Biwa, Shiga Prefecture.
6. ditto.

PLATE I



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4



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6

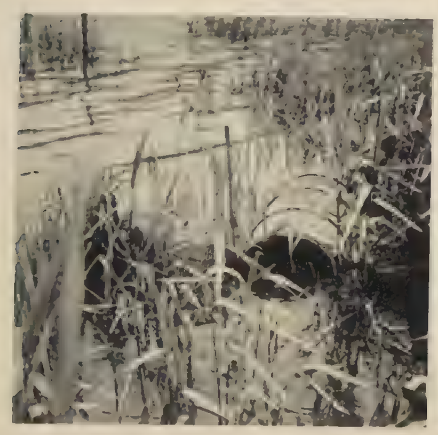
Plate II

1. Many kinds of fish trap. 1). A fish trap used in Lake Biwa, Shiga Prefecture to catch *Pseudorasbora* 2). A fish trap to use for weir "Eri" 3). A fish trap to catch loach and eel, used in Lake Biwa.
2. A large trap to set in the river at Matsubara, Hikone, Shiga Prefecture.
3. A variety of fish trap "Mondori" used in the river Yoshino, Nara Prefecture.
4. A variety of fish trap "Unagi Mondori" used in the river Yoshino, Nara Prefecture.
5. An eel trap, used at Ieki, around the dam, Mie Prefecture.
6. A bamboo trap and an eel trap used in the River Ano, Mie Prefecture.
7. A large bamboo fish trap to catch Cottus Kazika in the River Zintsu, around Katsuyama, Fukui Prefecture.

PLATE II



1



2



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7

Plate III

1. A net basket trap called "Amiuke", used in Lake Suwa, Nagano Prefecture.
2. A net basket trap "Mondori", used in Lake Biwa to catch carp or crucian carp is shallow waters.
3. A small set net "Dashiami" used in Kihara-mura, Ibaraki Prefecture.
4. A part of the funnel shaped entrance inside of the net basket, used in Kihara-mura, Ibaraki Prefecture.
5. A kind of cover nets "Oshi Ami", used in Lake Biwa, Shiga Prefecture.





2



3



4



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Plate IV

1. A carp trap used in Kihara-mura, Inashiki-gun, Ibaraki Prefecture.
2. ditto.
3. A carp fishing "Koi Tatsube fishing" carried in Lake Biwa, Shiga Prefecture.
4. A carp trap, called "Koi tatsube", used in Lake Biwa, Shiga Prefecture.
5. A boat coming back in the morning from trap fishing in Lake Suwa, Nagano Prefecture.
6. A carp trap "Koi Degoshi" used in Lake Suwa, Nagano Prefecture.



1



2



3



4



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6

Plate V

1. A peculiar box trap "Jindô" used in the River Yoshino, Nara Prefecture to catch Ayu-fish, carp, crucian carp and other freshwater fishes.
2. ditto.
3. A fiish trap fishing "Trap fishing" carried in Lake Biwa, Shiga Prefecture.
4. A ceder-lined trap used in Lake Matsubara, Nagano Prefecture.
5. A cedar-lined trap used in Kihara-mura, Inashiki-gun, Ibaraki Prefecture.
6. ditto.



1



2



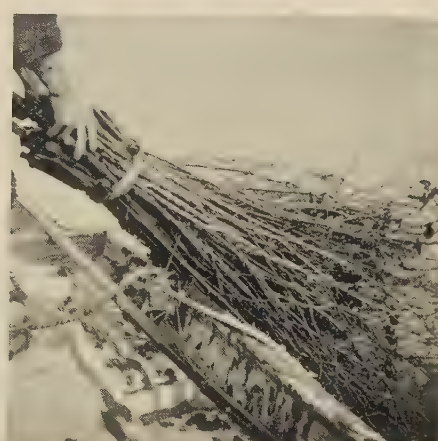
3



4



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6

Plate VI

1. A large bamboo screen labyrinth "Eri" in Lake Biwa, Shiga Prefecture.
2. A small bamboo screen labyrinth "Koeri" at the mouth of the River Matsubara, Hikone, Shiga Prefecture,
3. Catching fish from the dead end of labyrinth, scooping with dip-net, in Lake Biwa, Shiga Prefecture.
4. A small bamboo screen labyrinth in Lake Yogo, Shiga Prefecture.
5. A set of equipments to make a stone mound "Ishizuka" in Lake Suwa, Nagano Prefecture.
6. A stone mound of Lake Suwa in the spring, Nagano Prefecture.
7. A stone mound of Lake Suwa in the winter, Nagano Prefecture.

PLATE VI



1



2



3



4



5



6



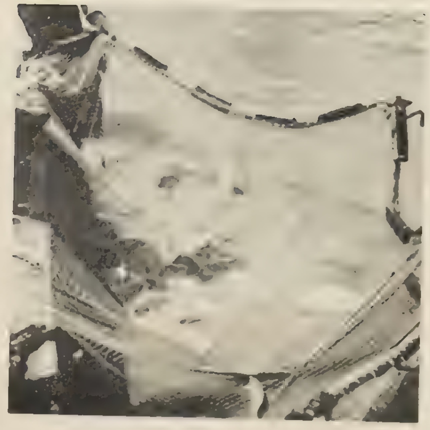
7

Plate VII

1. A small primitive modified screen-pound net "Kodo". This belongs to the bamboo screen labyrinth "Eri", and is used in the rivers of Niigata Prefecture to catch salmon.
2. A kind of beach seine "Hiuwo Biki" used in Lake Biwa, Shiga Prefecture to catch Koayu-fish.
3. A kind of sailing trawl "Komase Ami" to catch shrimp and small fish, used in Kihara-mura, Inashiki-gun Ibaraki Prefecture.
4. ditto.
5. ditto.

PLATE VII


1


3


2


4


5

Plate VIII

1. A gill net called "Taketaga" in Lake Suwa, Nagano Prefecture to catch carp and crucian carp.
2. A gill net called "Kiyome" in Lake Suwa, Nagano Prefecture to catch smelt.
3. A gill net called "Koito Ami" in Lake Biwa, Shiga Prefecture to catch Ayu-fish.
4. A hand casting net used in Mie Prefecture.
5. A hand casting net used in Lake Suwa, Nagano Prefecture to catch smelt.
6. ditto.



1



2



3



4



5



6

Plate IX

1. A common fish weir "Yana" in the River Amanogawa, Lake Biwa, Shiga Prefecture to catch "Koayu-fish."
2. ditto.
3. A common fish weir in the River Tenryû, Nagano Prefecture.
4. A view of building the fish weir in the River Tenryû, Nagano Prefecture.
5. A common fish weir to catch "Koayu-fish".
6. A fish weir to set in the mouth of the River Chinai, Lake Biwa, Shiga Prefecture.



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2



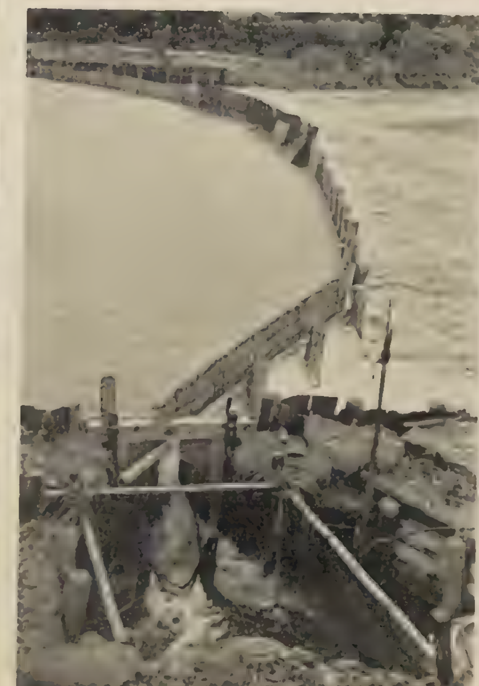
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5



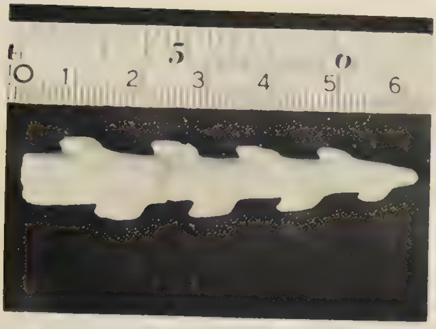
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Plate X

1. A deer antler hook discovered from a shell mound, Funakoshi-mura, Mie Prefecture.
2. A harpoon used in the River Yoshino, Nara Prefecture.
3. A larger harpoon used in the River Yoshino, Nara Prefecture.
4. Harpoon fishing at Oizumi, Mie Prefecture.
5. Fisheries of *Cobitis delicata*, using a small bamboo trap in the river Wara, Gifu Prefecture.
6. ditto.



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Plate XI

1. A small square net used in Lake Suwa, Nagano Prefecture to catch smelt.
2. A small square net used in the mouth of rivers of Lake Suwa, when smelt ascends the river at spawning season.
3. A large square net used in Lake Suwa, Nagano Prefecture to catch carp and crucian carp when they are coming into shallow waters of the lake side to spawn. This fishery is mostly carried out at night.
4. A large square net used in the beach of Lake Suwa, Nagano Prefectures and other lakes.
5. A dip net used in Mie Prefecture.
6. A kind of dip nets "Kassukui" used in the River Tenryû, Nagano Prefecture.

PLATE XI



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Plate XII

1. Night Fishing with cormorants, River Nagara, Gifu Prefecture.
2. Adjusting a cormorant's harness by skilful famous fisherman Mr. YAMASHITA, Gifu, Gifu Prefecture.
3. Night Fishing with many cormorants, River Nagara, Gifu Prefecture.
4. Disgorging fishes from oesophagus of a cormorant.
5. Training of cormorants in a river during winter.
6. The head and next cormorants wearing their harnesses.



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4



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6

II. Special Part

Contents

I Systematic account

Superclass AGNATHA

Class I Cyclostomata

Characters: Fish or fish-like vertebrates, body naked, eel-like; the skeleton cartilagenous or fibrous, without bone; no definitely developed jaws or bony teeth; at least the rudiments of a cranium present in the form of a simple trough below the brain in some, but partially roofed in others; notochord not constricted at all segmentally; vertebral column represented by a simple notochordal sheath; without vertebral centra, but with rudimentary neural arches in some; no limb girdles, no paired fins, and no true ribs. A single median nasal opening between the eyes, naso-hypophyseal sac not communicating with the pharynx; 6 to 14 pairs of gill pouches opening either directly into the pharynx internally or into a separate respiratory tube, which in turn opens into the mouth below the gullet, no ductus oesophageo-cutaneous, and to the exterior either separately or by a single aperture on each side; skin without scales; single nostril, either opening to the mouth or not; intestine with internal longitudinal ridges, or with a slight spiral ford; ear with only 1 or 2 semicircular canals no sympathetic nervous system, or spleen, heart without conus arteriosus; no cloaca, the genital apertures being separate from the anus. Development oviparous, with or whithout a definite larval stage; the sexes separate or not.

Order Petromyzonida

Characters: Body naked, eel-like in form. No paired fins or limb girdles. Seven pairs of gill pouches open separately to the exterior, but open inwardly into a special respiratory tube which separates from the pharynx and which ends blind, posteriolly; however, this respiratory tube connects with the intestine, while a new pharnyx develops above it to form a forward extension of the intestine which connects with the mouth. Snout without barbels; dorsal and caudal fins separate, supported by rays; nostril a blind sac, on dorsal surface of head, not opening into mouth; mouth suctorial, transformed into a respiratory organ, opens as funnel or disc surrounded by a circular

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The author appreciate with the help of Mr. KIYOSHI SUZUKI for the measurements of the specimens preserved in many laboratories and also with the endeavours of Mr. Y. WATANABE to make sketches of many specimens.

lip with numerous horny teeth; sides of trunk without prominent rows of mucous pores; ear with two semicircular canals; internally the labrinth partly covered with a ciliary epithelium; sacculus and lagena present; eye well-developed, with lens and iris in adult, rudimentary in larva; notochord persistent. No vertebral centra; neural arches rudimentary, represented by two pairs of cartilagenous rods in each segment above the notochord. The fourth somite provided with a normal myotome. Myotomes not subdivided by a horizontal septum into dorsal and ventral halves. Dorsal roots of spinal nerves not united with ventral roots. Sexes separate; eggs small, holoblastic, numerous; development with larval stage, differs in appearance structually from the adult.

Family Petromyzonidae

Characters: Body eel-shaped, subcylindrical anteriorly, compressed behind; the mouth nearly circular, suctorial, usually armed with horny teeth, or tooth-like tubercles which are simple or multicuspid consisting of papillae; lacking the ordinary upper and lower jaws; the paired fins absent, those immediately above and those immediately below the oesophagus more or less specialized; eyes developed in the adult; external gill openings 7, arranged in a row along the sides of the 2 chests; nostril on the tip of the head just in front of the eyes; lips present, usually fringed; dorsal fin more or less deeply divided by a notch, the posterior part commonly continuous with the anal fin around the tail; intestines with a spiral valve; eggs small.

These animals undergo metamorphoses; the youngs are usually toothless and have rudimentary eyes. Separate generic names (*Ammocetes*, *Scolecisina*, *Chilopterus*) had been applied to these larval forms before it was discovered that they were the normal young of the true lampreys. The lampreys inhabit rivers of temperate regions. They attach themselves to fishes feed by scraping off the flesh with their rasp-like teeth. Most of them ascend rivers or brooks at the spawning season, after which very many of the individuals die.

Key to the Japanese genera of Petromyzonidae

a^1. Dorsal fin separate. Both inner lateral teeth connected at the ends and very small labial teeth row running in parallel with marginal labial teeth. .... **Entosphenus**

a^2. Dorsal fin closed or connected. No lateral teeth row connected with both inner lateral labial teeth .... **Lampetra**

Genus Entosphenus GILL, 1863.

Entosphenus, GILL, 1862, Proc. Ac. Nat. Sic., Phila., p. 331.

Characters: Body of small or large size, with the dorsal fin emarginate or divided into two parts, the posterior portion continuous with the low anal fin around the tail; supraoral lamina broad, forming a crescent-shaped plate, with a large bluntish cusp at each end and rarely a very small median cusp; lingual teeth small, with a cresent-shaped dentate edge, the median denticle enlarged. Lips fringed; buccal disk moderate, its teeth comparatively few.

Key to the Japanese species of Entosphenus

a[1]. Dorsal fin divided into two parts, separate, or joined at base only; infraoral lamina with 6 to 8 sharp cusps. Myomeres 69-77. .... **E. japonicus**

a[2]. Dorsal fin distinctly continuous, but with a sharp notch; infraoral lamina with 8 sharp cusps. Myomeres 68-74. .... **E. tridentatus tridentatus**

1. Entosphenus japonicus (VON MARTENS).

Eight-eyed Eel, "Yatsumeunagi, Kawayatsume"
(Text-figs. 29, 30)

Petromyzon fluviatilis LINN., 1758, Syst. Nat., Icth. ed., p. 230. - ISHIKAWA, 1897, Prel. Cat., p. 63.

Petromyzon japonicus VON MARTENS, 1868, Archiv. Naturg., 34, p. 3 -GUNTHER, 1870, Cat. Fish., vol. 8, p. 504. - JORDAN, 1891, Annot. Zool. Jap., Vol. 3, p. 37. - KATÔ, 1906, Zool. Mag., 18 (207), pp. 27-29. -YAMASHITA, 1937, p. 2.

Lampetra japonica HATTA, 1901, Annot. Zool. Japon., vol. 4, pp. 21-29. -TANAKA, 1908, Zool. Mag., no. 237, p. 233. -KOSHIDA, 1908, Suisan Kenkûshi. 3 (9), pp. 225-227. -KOSHIDA, 1909, Zool. Mag., no. 244, p. 63. TANAKA, 1909, Zool. Mag., no. 249, p. 289. -HUBBS, 1922, Occas. Pap. Mus. Zool. Univ. Mich., no. 120. p. 11, -OKADA et IKEDA 1938, Sci. Report Tôkyô Bunrika Daigaku, Sect. B. no. 55, p. 140. -MORI, 1936, Stud. Geo. Dist. Eastern Asia, p. 15.

Lampetra fluviatilis OKADA et IKEDA, 1938, Saitô Hô-Onkai Mus., Res. Bull., no. 15, pp. 85, 86.

Lampetra fluviatilis japonica BERG, 1926, Acad. de Lunion des Repub., Soviet Soc. Livraison, 2, p. 2. -TANAKA, 1936. Nihon no Gyorui.

Entosphenus japonicus JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, p. 98; -MIYADI, Kyôtofuka no Tansuigyo, pp. 7-9. -KOBAYASHI, 1936, Zool. Mag., 48 (4), pp. 236-237. MATSUBARA, 1955, Fish Morph. and Hier., p. 95. -AOYAGI, 1957, Gen. Notes Fresh. Fish. Japan. Archip., pp. 10-12, figs. 4-6.



Text-fig. 29. ***Entosphenus japonicus*** (VON MARTENS). × 1

The original description* is as follows

Petromyzon japonicus n. sp. Taf. 1, fig. 2.

Oben schieefrgrau, an den Seiten und unten silber-glänzend. Länge 0.0454m., Entfernug des Auges von der Schnauze 0.029m. Umfang am hintersten Kiemenloch 0.071m. Die erste Rückenflosse beginnt ein wenig hinter der Mitte des Körpers, 0.224m. vom vordern Körperende entfernt, und ist von der

*EDWARD V. MARTENS:- Ueber einige ostasiatische Süsswasserthiere. Archiv. für Naturgeschichte. 1868, vol. 34, Bd. 1, pp. 3-5 (pp. 1-64, pl. 1).

zweiten durch einen Zwischenraum getrennt, welcher dae 2½ fache des Augendurchmessers beträgt. After 0.116m. vor dem hintern Ende Spritzloch weiter nach vorn als der vordere Augenrand. Eine halsbandförmigee infache Bogenreihe von Schleimporen eine Strecke hinter der Unterlipps. Die Anordnung der Hornzähne ist ähnlich wie bei *Petromyzon fluviatilis* L. und verweist die neue Art in dieselbe Unterabthelung (*Lampetra* GRAY 1851, non MALM, *Petromyzon* MALM 1861, non GRAY). Die Zähnchen des Mundrandes in einer Reihe, schlank und spitzig, alle gleich gross, die Reihe nur oben nicht geschlossen. Zwischen diesen äussersten Zahnkranze und den zusammengesetzten Zähnen in Innern

Table 8. Measurements of *Entosphenus japonicus* (V. MARTENS).

Collection	O. H. B. S.*			
Total length	14.0mm.	11.0mm.	15.2mm.	36.7mm.
Body length	14.0	11.0	15.2	36.7
Body length/Head	5.0	4.58	5.84	4.83
Body length/Depth	17.5	18.4	15.2	15.3
Body length/Preanal length	1.03	1.34	1.41	(Tip of Snout Anus) 1.39
Date		X, 1910		IV, 1913
Locality	Ishikari, Hokkaidô			Sapporo Hokkaidô

*O. H. B. S. Ôtsu Hydrobiological Station attached to Faculty of Science, Kyôto University.

des Mundes unten eine einfache Reihe ebenso kleiner, ähnlich geformter Zähnchen, 16 an der Zahl, oben dagegen mehrere grössere, in quincunx stehend, nach innen an Gösse zunehmend. Von den zusammengesetzten Zähnen ist der obere (upper inner tooth bei GRAY, Pflugbeinszahn bei MALM) halbmond förmig, jeberseist in eine starke, nach vorn und unten gerichteten Spitzen, wovon die innere stets die stärkere. Unterer zusammengesetzter Zahn (lower inner tooth MALMS) jederseits drei, jeder mit zwei nach innen und vorn gerichteten Spitzen, wovon die innere stets die stärkere. Unterer zu sammengesetzter Zahn (lower inner tooth GRAY, zusammengesetzter Unterkieferzahn MALM) mit sechs nach vorn gerichteten Spitzen, wovon die zwei äussersten stärker, die vier innen gleich. Unterer Zahn der Zunge (äusserer Zungenzahn bei MALM) quer verbreitert ohne Mittelfurche, mit einer starken Mittelspitze und jederseits nur vier seitlichen, alle aufwärts gerichtet; oberer Zungenzahn (Schluckzahntbei MALM), paarig, schmal, mit einander zugewandten zahlreichen Spitzen.



Text-fig. 30. Mouth of ***Entosphenus japonicus*** (VON MARTENS). ×3

TILESIUS hat in PALLAS' Zoographia Rosso-asiatica vol. III, pag 67 einen *Petromyzon marinus camtschaticus* beschreiben, welcher in Gösse und Färbung dem unsrigen ähnlich scheint, aber weder was von der Stellung der Zähne, noch von der abgestutzten Form der Schwanzflosse gesagt wird, kann ich auf die unsrige beziehen; ferner soll das Spritzloch zwischen den Augen stehen und die Schlemiporen der

Unterseite des Kopfes beiderseits eine Schlangenlinie bilden. Die citirte Abbildung ist leider nicht auf unserer Bibliothek vorhanden.

Description: Supraoral lamina forming a long, crescentic plate, with a sharp cusp at either end; no median cusp; infraoral lamina with seven (six to eight) sharp cusps, which are nearly equal, except that the outer is much broader than the others; lateral teeth, three on each side, each with two cusps; tongue with nine cusps, the median much the largest; lips fringed; two rows of simple teeth in front of mouth above. Dorsal fins entirely separate, the first not quite half the height of the second, the interspace 2 $^{2}/_{5}$ in head; 2 $^{3}/_{4}$ in length of first dorsal. Gill openings, 7; head, 1 $^{1}/_{10}$ in thorax; snout, 1 $^{3}/_{4}$ in head; head, 10 in total length; greatest depth, 1 $^{2}/_{5}$ in head. Tail 4 $^{1}/_{4}$ in total length. Blackish; paler below; tail darker; dorsal edges pale.

Remarks: GÜNTHER (1870) noted in his paper that *Petromyzon japonicus* does not appear to me to be specifically distinct from *P. fluviatilis*. The dentition in both is extremely similar, only the Japanese example has an additional transverse series of small teeth behind the mandibulary tooth.

JORDAN and SNYDER noted that this species is very close to *Lampetra aurea* (BEAN) of the Yukon River, and to *Lampetra fluviatilis* LINNAEUS, of the streams of Europe. Their material is not sufficient to show that it is really different from either or both of these. It is, however, undesirable to unite nominal species from widely separated regions until identify is actually shown. This species seems to have a higher second dorsal than the European species. From HATTA's map of the distribution of lampreys in Japan, it is evident that the present species has a much more southerly range than the other. This would indicate that it is not identical with the Lamprey of the Yukon. The species is known in Japan as "Yatsumeunagi", or Eight-eyed Eel.

GÜNTHER mentioned in 1870 in his catalogue, p. 504, "*Petromyzon japonicus* MARTENS, Wiegm. Archiv. xxxiv. p. 3, does not appear to me to be specifically distinct from *P. fluviatilis*. The dentition in both is extremely similar, only the Japanese example has an additional transverse series of small teeth behind the mandibulary tooth." The figure accompanying the description of *P. japonicus* is incorrect, and I am indebted to Prof. PETERS for reexamination of the typical specimen. JORDAN (1891) has called it in his "Preliminary Check List of the Fishes of Japan" *Petromyzon japonicus* following MARTENS' Nomenclature. MIYADI mentioned that *Entosphenus japonicus* is found in the streams flowing into Wakasa Bay of Kyôto. He has also mentioned the distribution extending from Hokkaidô and rivers of the Japan sea coast and also in Kosanchi, Tottori Prefecture. JORDAN and HUBBS (1922) described nine specimens of *Entosphenus japonicus* from Japan, Alaska, and northern Asia which were obtained by S. TAKAYASU from Karafuto near Otaru in western Hokkaidô. They reconginzed these specimens are quite typical in many characters. They have added the remarks of the distribution and characteristics of the species already discussed by CREASER and HUBBS. (1922).

According to AOYAGI (1957), the breeding season comes from April to June (water temperature of that season changes from 13° to 16°). Egg contents show about 70,000.

Before spawning, female and male ascend with all together to a river during the beginning of March and arrived a small stream with a water current to make a small hollow on the bottom called "Hori" in Japanese. A female rests in the hollow and several males swim themselves round a female to spawn. The spawning continues during several days and the spawened eggs are covered gradually with sands.

WEISSENBERG (1927) mentioned that the dorsal fins of the European *Lampetra fluviatilis* connect together temporaly during breeding season, but in Japanese *Lampetra japonica* not confirmed with such facts. On accounts of SHUN, OKADA's description, they are dark green, adhesive, measured 1–1.2 mm. in diameter (by SHUN, OKADA 1937). Ammocoetes found in Chitose River, Hokkaidô, measured 90–133–175 mm. in body length. The metamorphosic period occurred from the end of summer to the beginning of winter. After the metamorphosing, the ammocoetes burried into mud and hibernate during winter. Then they descend a river into sea. They measured 133–175 mm. during that time. The adult is very active in night and omnivorous. They feed on bottom animals and small fishes in a river, after descending into sea, they sucked on fish to eat fresh.

Distribution: Aomori Prefecture; Akita Prefecture; Miyagi Prefecture; Yamagata Prefecture, (OKADA & IKEDA); Toyama (YAMASHITA); River Nagara, Gifu, (OKADA); Nagano Prefecture; Lake Biwa; Hokkaidô (MORI); Yokohama; Echigo (HATTA); Kyôto (MIYADI); Fukui Prefecture; River Ashiba, Katsuyama Ôno-Gun; Ôno, Ono-Gun (KATÔ); Lake Iwashiro (KOSHIDA); Echigo; Yokohama (JORDAN & SNYDER); Yamagata; Niigata; Takata; R. Shimizu; Totomi, Owari; Kyôto, Uji in Yanashiro; Lake Biwa at Nagahama in ômi, (ISHIKAWA); Otaru (JORDAN & HUBBS); Rvier Eno, Shimane Prefecture (TANAKA); River Tone, Ibaraki Prefecture (TAKATSUKA); Sapporo, Hokkaidô (HIKIDA); Atsugetsu, Ishikari, Hokkaidô (HIKIDA); Abashiri Dake, Hokkaidô (OKADA & IKEDA).

2. **Entosphenus tridentatus** (GAIRDNER).

"Yuhutsu Yatsume"

(Test-fig. 31)

Entosphenus tridentatus EVERMANN et GOLDSBOROUGH, 1906, The Fishes of Alaska. p. 227., fig. 2.
Lampetra tridentata OKADA et IKEDA, 1938, Sc. Rep. Tokyo Bunrika Daigaku, Sect, B. no. 55, p. 140. – AOYAGI, 1953, Gen. Notes Fresh. Fish. Jap. Archip., pp. 9–10, fig. 3.

EVERMANN described as follows; Four specimens 16 to 18 inches long collected by CHAMBERLAIN in Naha River Loring, June 23, 1903, and 6 inch specimen seined by him in McDonald Lake, August 24, 1905. CHAMBERLAIN reports that lampreys were quite abundant June 22, at the foot of Dorr Falls in Naha stream. More than 50 were observed attached to the rocks. They were first noticed June 20 and all had disappeared

in a week or ten days. Five males and 5 females were examined. Of the latter all but one appeared to have completed spawning.

At the Yes Bay hatchery a number of young were caught in the flume which brings water to the hatchery from a point of the creek below the falls.

It is believed that the lamprey spawns among the rocks at the foot of that falls. This species was recorded at Unalaska, by GILBERT in 1895.

Distribution: Yûhutu River, Hokkaidô (OKADA).



Text-fig. 31. ***Entosphenus tridentatus*** (GAIRDNER). ×1

Genus **Lampetra** GRAY, 1851.

Lampetra GRAY, 1851, Proc. Zool. Soc. London, p. 235.

Characters: Body of small size, with the dorsal fin emarginate or divided into two parts, the posterior portion continous with the low anal fin around the tail; supraoral lamina broad, forming a crescentic plate, with a large bluntish cusp at each end and rarely a very small median cusp; lingual teeth small, with a crescent-shaped dentate edge, the median denticle enlarged; buccal disk small, its teeth few and never tricuspid.

3. **Lampetra reissneri** (DYBOWSKI).

Brook lamprey, "Sunayatsume"

(PL. XIII figs. 1–7; PL. XIV figs. 1–16)

Lampetra reissneri MORI, 1936, Stud. Geog. Dist. Fresh-water fish Eastern Asia, pp. 3, 15.

Lampetra planeri reissneri BERG, 1926, Acad. des Sci., de Union des Repub. Soviet. Soc., Luraison 2, p. 2.

Lampetra planeri JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Japan. p. 6. – OKADA et IKEDA, 1938, Saito Hô-on Kai Mus., Res. Bull., no. 15, pp. 86-87. – IKEDA, 1937, Hakubutsugaku-Zassi, vol. 35, no. 60, p. 108. – AOYAGI, 1957. Gen. Notes Fresh Fish. Japan Archip., pp. 13–15. figs. 9–10.

Lampetra mitsukurii HATTA, Annot. Zool. Jap., iv, no. 1, part 1, p. 24. – JORDAN et SNYDER, 1900, Proc. U. S. N. M., p. 336.– JORDAN et SNYDER, 1901, Cat. Fish Japan, p. 1909. – Proc. U. S. N. M., 23. (1233), p. 734.

Lamptera mitsukurii minor HATTA, 1911, Annot. Zool. Jap., vii, part v, p. 268.

Entosphenus mitsukurii MIYADI, Kyôtofu no Tansuigyo, pp. 7–9.

Description: Supraoral lamina forming a crescentic plate, shorter than in *Lampera japonica*, the cusp at either end shorter and more obtuse; infraoral lamina with about 6 blunt cusps, the outer ones much broader and longer than the others; lateral teeth three on each side, each bicuspid and blunt, two or three rows of simple teeth in front of supraoral lamina; lips fringed. Dorsal fins connecting the two dorsal fins about one-third height of first. Head 11.8 in first dorsal, about one-tenth longer than thorax; gill openings, 7, head, 9, total length; tail 4, 62 muscular impressions between gill openings and vent. Color bluish-black, the belly white; tip of tail blackish; fins pale, darker around the edges.

Table 9. Measurements of *Lampetra reissneri* (DYBOWSKY).

Collection	O. H. B. S.*		
Total length	158.0 mm.	200.0 mm.	168.0 mm.
Body length	155.0	198.0	167.0
Body length/Head	5.08	5.74	5.05
Body length/Depth	19.40	18.00	16.70
Body length/Predorsal length	1.89	2.20	1.93
Head/Interorbital width	6.10	6.64	6.27
Head/Diameter of Eye	12.20	15.70	14.40
Head/Length of Dorsal fin	1.39	1.04	1.01
Head/Height of Dorsal fin	6.80	8.03	7.72
Date	IV, 1914	IV, 1914	IV, 1915
Locality	Lake Biwa	Lake Biwa	Hokkaidô

* Ôtsu Hydrobiological Station attached to Kyôto University.

Remarks: JORDAN and SNYDER mentioned that the present species is related to *Lampetra wilderi* of the eastern United States, and still, more closely to *Lampetra planeri* (BLOCH) of Europe. It will require actual comparison of specimens in widely separated it from the latter, but their experience with other species in widely separated regions shows that it is very hazardous to assume identity of species simply because superficial and non-comparative descriptions indicate no difference. The Japanese species seems to reach a large size and to have higher fins than the European species.

MIYADI mentioned *Entosphenus mitsukurii* from Kyôto-Fu, distributed in Yodo and Yura Rivers. He has also added that the present species is a land locked form, distributing widely from the Kuriles and Saghalien to Kyushû. This rather smaller than 15 cm. body length, teeth weak and bluntly pointed, without small teeth connecting with the lateral teeth on the out side of the lower mandibular teeth. Sucker projected. Ammocetes stage 5 to 6 years, metamorphosing from summer through autumn and over winter to the adult stage. Spawn in the next spring and die, never go down to sea.

The degenerate Brook-Lampreys of Japan have been referred by REGAN and by JORDAN, TANAKA, and SNYDER, to the European *Lamptera planeri* while CREASER and HUBBS in their last review of the family although showing the species *L. mitsukurii* to be

an *Entosphenus*, still thought that *Lampetra planeri* also occured in Japan. On re-examining the material of this group in the Stanford collections we find nothing but *Entosphenus mitsukurii*, and only that species is represented in the collection upon which we are now reporting. We think it improbable that *Lampetra planeri* occurs in Japan. *Entosphenus mitsukurii* differs from the commonest of the three Brook-Lampreys of the eastern United States, namely *Entosphenus appendix*, with which CREASER and HUBBS confused it, in having fewer myotomes and less palmate oral fimbriae. It is closely related to *E. appendix*, however, and both of these brook forms were obviously derived from a sea-run species like *Entosphenus japonicus*. These three species together comprise a distinct group called *Lethenteron* by CREASER and HUBBS.

Like the Brook-lampreys of other regions, those of Japan break up into a complex of local races, differing in degree of degeneration. For this reason we list our specimens separately.

Anmmocoete 131 mm. long, collected by S. NAKANO in Shinshû, has 56 myotomes between the last gill-opening and the anus.

Two recently transformed specimens, with the teeth soft and imperfect (but typically arranged) were taken by R. ABE at HIMEJI. One is a female with developed anal fin; 92 mm. in total length, with 59 myotomes in the trunk. The other is a male, with elongate penis; 86 mm. in total length; 58 myotomes. Two examples, 121 & 145 mm. in length, myotomes 56 or 57 were taken in Lake Biwa. Two from Sapporo, Hokkaidô, presented by Dr. KAWAMURA, are especially aberrant. One is a mature male, 147 mm. long, with 67 myotomes in standard count, and the coloration mottled. The other is a mature female, 142 mm. long, with 63 myotomes and the coloration plain.

In the specimens preserved in the Saitô Hô-on Kai Museum at Sendai, Miyagi Prefecture, are recognized the variations in the numbers of myotome as indicated in the following table.

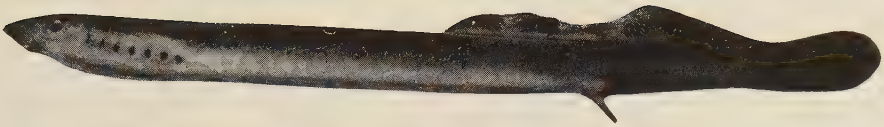
Table 10. Numbers of myotome counted from the last gill opening to the front edge of anus, in *E. reissneri* (DYBOWSKY).

Numbers of myotome / Reg. No. Specimens	56	57	58	59	60
5618	2	1		3	
10481	1		1		1
15183					
16854		1	2	1	
13817			1	1	
19633		1			1

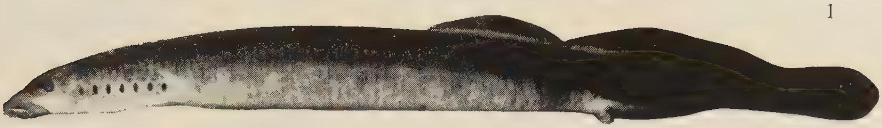
Development: In 1907, S. HATTA* studied on the gastrulation in *Petromyzon japonicus* collected at Sapporo, Hokkaidô and Tôkyô. He has observed the normal development of the species and mentioned the embryological facts in details. (PL. XIV, figs. 1–16). Here, the author tried to describe the general development from the old morula to

*S. HATTA, 1907, Jour. Coll. Scie. Imp. Univ. Tôkyô, vol. XXI, art. II, pp. 1-44, pls. 1-3.

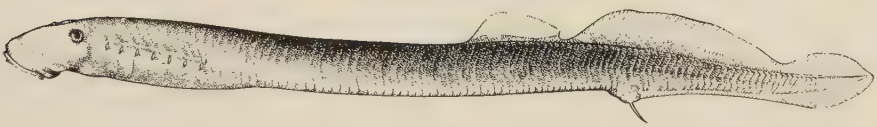
the early stage of larva just hatching. A morula (fig. 1) has the upper translucent part on animal hemisphere (a. h.) and the lower opaque part on vegetative hemisphere. In a fully grown morula, the animal hemisphere has become much larger than that in the former stage, while the vegetative hemisphere (v. h.) is rather reduced in extent. (fig. 2). The portion of the extent of the animal and vegetative hemispheres is well seen, the latter is about 1/4 of the former in bulk. (fig. 3). In an advanced stage, the part giving rise to the conical eminence is strongly compressed from side to side. The boundary groove (b. g.) has become deeper and is extended farther ventrally (fig. 4). In a stage (fig. 5) the gastrula invagination has just begun; the boundary groove has extended itself farther ventrally. The blastpore (bp.) is seen like a nail-mark below the conical eminence (c. e. m.). Next stage (fig. 6), has a little further development of the invagination; the conical eminence is converted into a flattened and broad elevation (em. s.), the embryonic shield, and consequently the boundary groove is curved anteriorly. In a further advanced stage, the constriction of the boundary groove is not striking, but now sourrounds the ovum completely; the basal surface is depressed and flattened further ventrally. The embryonic shield has become broader, the boundary groove has shifted anteriorly in consequence of the advancing invagination. (fig. 7). In this stage (fig. 8), the translucent part is reduced, in consequence of the progressing invagination, into a small vesicle at the anterior end of the ovum and is separated from the opaque embryonic shield by the strongly curved boundary groove (b. g.). The largest part of the ovum is occupied by the opaque solid part, the embryonic shield (em. s.); capping this is seen the small translucent vesicle at the anterior end. Both limbs of the arc described by the blastoporic lip (bp. l.) are brought nearer to the median line and to each other, while the blastoporic depression has become deeper than before. In a further advanced ovum, the whole extent of the dorsal surface is occupied by the embryonic shield (em. s.). The translucent vesicle is driven into the ventral side of the anterior part and is seen as a slight swelling. A great deal of the vegetative hemisphere remains still exposed; accordingly, the ovum is somewhat conical in shape, the posterior part being bulged out. The blastoporic depression (bp.) has become deeper and narrower, but ventrally it passes over gradually into the vegetative field which is still spherical in shape, wanting as yet the ventral blastoporic lip. (fig. 9). In a next stage, there is no longer seen any trace of the translucent vesicle. The segmentation cavity is thoroughly obliterated. The ovum exhibits a pear-shape, being larger in the anterior part and lessening in bulk posteriorly. The dorsal surface is no longer plain, but there is expressed an oval elevation (m. p.), the medullary plate, along the medllary plate, along the median line of which is seen the "Rückenrinne" running lengthwise. (fig. 10). In a much advanced ovum, the medullary plate is converted into a pair of prominent medullary ridges (m. r.). The ventral lip (vl. bp.) of the blastopore is established (fig. 11). Early embryo has the head-fold raised over the general level of the egg, and is protruded a little forwards, although being confined within the chorion, it is necessarily bent backwards and pressed down on the blastoderm. The neural ridge which was slightly marked in the foregoing stage becomes prominent along the dorsal



1



2



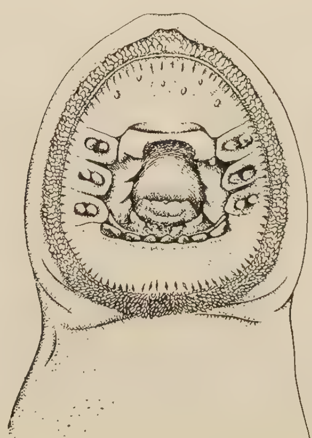
3



4







5 6

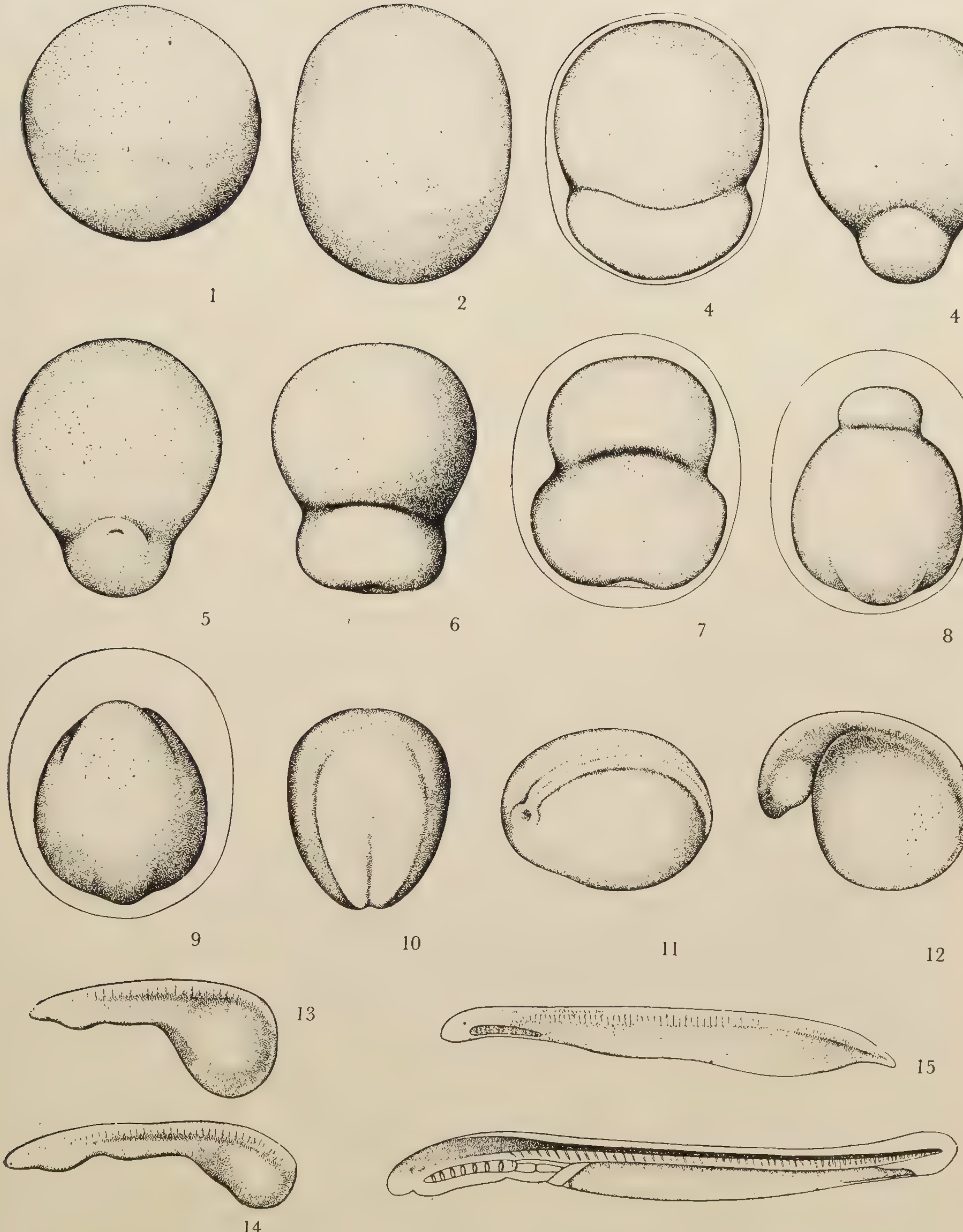
1. ***Lampetra reissneri*** (DYBOWSKI). ♂ ×1
2. ***Lampetra reissneri*** (DYBOWSKI). ♀ ×1
3. ***Lampetra reissneri*** (DYBOWSKI). ♂ ×1
4. ***Lampetra reissneri*** (DYBOWSKI). ♀ ×1
5. Male genital papillae of ***L. reissneri*** (D.). ♂ ×2
6. Female genital papillae of ***L. reissneri*** (D.). ♀ ×2
7. Mouth part of ***Lampetra reissneri*** (D.). ×5

PLATE XIV

Surface view of the egg development of ***Petromyozon***, (after S. HATTA) 1897, 1907.

1. A morula stage. ×60.
2. A fully grown morula. ×60.
3. Side view of a further advanced ovum. ×60.
4. Dorsal view of a little further developed ovum. ×60.
5. Dorsal view of an ovum in which the gastrula invagination has just began. ×60.
6. Dorsal view of an ovum in which the invagination has gone a little further. ×60.
7. Dorsal view of a further advanced ovum. ×60.
8. Dorsal view of an ovum in which the translucent part is reduced, in consequence of the progressing invagination. ×60.
9. Dorsal view of a further advanced ovum. ×60.
10. Dorsal view of a further advanced ovum. ×60.
11. Dorsal view of a further advanced ovum. ×60.
12. A much advanced ovum, seen from the dorsal and posterior sides. ×60.
13. Larva of side view. ×60.
14. Successive stage of larva, side view. ×60.
15. Successive stage of larva, side view. ×60.
16. Successive stage of larva, side view. ×60.

PLATE XIV



longitudinal line (fig. 12). The egg membrane is broken about the end of this stage, the embryo straightens and becomes retort-shaped (fig. 13). It measures about 2.5 mm. and has from three to four pairs of the gill-invaginations. Many profound internal changes take place, such as the first appearance of the pronephros, of the heart, of the liver, and so forth. In the advanced stage (fig. 14), the embryo hatches spontaneously and is pistol-shaped, measuring about 3 mm. in length, with five pairs of the branchial invaginations. In the well-developed young stage, the tail-end begins to grow and to point out, it measures about 5 mm. and has from six to seven pairs of the gills. The gill-pouches being to open outwards and all pairs of the persistent gills acquire free communication with the exterior (fig. 15). The last young stage has the almost the same external features of the former stage, but the dorsal fin and a large part of the caudal are developed; measured 6.5 mm. long and has seven pairs of open gill-slits and one blind pair, provided with 73 pairs of the mesoblastic somites (fig. 16). The free swimming larva, having no longer any yolk-mass; the intestine is filled up with diatomes. It is about 9 mm. in body length and has about 97 pairs of the myotomes.
These descriptions are mostly accompained by S. Hatta.

Distribution: Akita Prefecture; Iwate Prefecture; Yamagata Prefecture. (Okada & Ikeda); Toyama (Yamashita), Yanagawa; Hiroshima; Fukuoka; Tôkyô; Lake Biwa (Jordan & Snyder); Hokkaidô (Mori); Tôkyô (Mitsukuri); Lake Biwa (Ishikawa); Gifu Prov.; Shinano; Kaga Prov.; Nanao; Noto; River Aka, Echigo; River Tama; Musashi; Saga, Hizen (Jordan, Tanaka, Snyder,) Hokkaidô; Hondô (Hatta); Katoda, Shiga Prefecture (Kawamura); Sapporo, Hokkaidô (Hikida); Baba, Innai, Okatsu-gun, Akita Prefecture (Takashisa).

Class II Osteichthys

Characters: Skull formed with sutures and with membranous bones, as opercle, preopercle, etc., present. Skeleton usually bony, though sometimes cartilaginous. Gill openings as one or several apertures on each side of pharynx. Gills filamentous, outer edges free, bases joined to bony arches of which there are usually 4 pairs and a fifth pair are typically formed as tooth-bearing lower pharyngeales. Air bladder at first a lung formed on lower side of oesophagus, but in latter forms placed superior, becomes degenerated into a swim-vessel, or entirely lost with age. Heart with auricle, ventricle, and arterial bulb. Eggs small. Fins median and paired, latter with distinct rays.

Subclass Teleostomi

Characters: Jaws and fins normally fish-like. Membranous head bones, as opercle, preopercle etc. developed. Skeleton sometimes cartilaginous, usually bony. Skull with sutures. Bones supporting fin rays, called actinosts or pterygials, greatly modified, though concealed by body integument. Usually 2 bones connect pectoral fin with shoulder girdle. Hypercoracoid flat, square, usually perforated by foramen. Variation in coracoids, sometimes imperfect or specially modified. Lung imperfectly developed, or dege-

nerated to form swim-vessel, ventricle and arterial bulb. Gills with outer edges free, their bases attached to bony arches, normally four pairs and a fifth pair typically modified into tooth bearing lower pharyngeals. Ova small. Median and paired fins usually present latter with distinct rays. No claspers. Lower Devonian to recent.

Superorder Chondrostei

Characters: Teeth small or absent. Subopercle and preopercle absent. Branchiostegales few or absent. Cartilaginous vertebrae imperfectly developed. Notochord persistent. Axinosts and baseosts of median fins arranged in simple regular series, rays more numerous than supporting elements. Pelvic fins with well-developed baseosts. Shoulder girdle with pair of infraclavicular plates. Optic nerves forming chiasma. Intestine with spiral valve. Body naked or with longitudinal rows of bony plates. Rhombic plates on tail. One dorsal and one anal fin distinct from caudal. Caudal fin usually hetrocercal. A pair of pectoral and a pair of ventrals fins.

Order Polyperida

Characters: Scales typical rhomboid, movable. Outer nostril in two pairs, without internal nostril. Spiracle present. Dorsal fin mostly separated in each small fins consisting of one to several fin rays and one strong fulcral scale. Caudal fin symmetrical; pectoral flabellate, with scale muscle peduncle. Skeleton somewhat ossified with many cartilage bones and with membrane bone. Rib and upper rib present, without intermuscular bone. Vertebrae amphicoelus without neural spine. Postoccipital large, with the foramen of glossopharygneal nerve. Large otolith in sacculus. Gill in 4 pairs. Without lower pharyngeal bone. Swim bladder divided into two bilaterally, connected to lower side of oesophagus with canal. Spiral valve in intestine.

Family Acipenseridae

Characters: Body elongate, partly cylindrical covered with 5 rows of bony plates. Head large, robust. Snout depressed, extended, conic or partly spatulate, with sensory areolae on lower surface. Eyes small. Mouth small, inferior, protractile. Lips thick, produced into marginal lobes. No-teeth, except microscopic ones in larval stages. To the palato-quadrate are united the following dermal bones, premaxillary, ectopterygoid, entopterygoid, and quadrate-jugal; of endochondral ossifications an autopalatine may be present in adult. Hyomandibular large, ossified in the middle part only, broadend below. Four barbels in transverse row below snout in front of the mouth. Nostrils large, double, olfactory membrane with smooth central disc surrounded by rosette of folds. Gills 4, also accessory opercular gill, gill-rakers few. Ribs well-developed, usually ossified. Branchial arches 5. Pseudobranchia imperfect. Gill membranes joined to isthmus. No branchiostegals. Air bladder large, joined to esophagus with short pneumatic duct, sides spacious. Pancreas divided into mushroom like pyloric appendages. Spiral valve in rectum. Five longitudinal rows of bony plates or bucklers, each with median keel ending in spine, sometimes a row on each side, last sometimes decidous.

Skin between large plates rough with small irregular plates. Head covered with bony plates joined with sutures. Fin rays slender, articulated. Vertical fins with fulcra. Dorsal fin behind ventrals. Anal fin similar and somewhat behind. Tail heterocercal, lower lobe well developed, and upper covered with rhomboid scales. Pectorals moderate, low. Ventrals many rayed, small, behind middle of body.

Genus **Acipenser** Linnaeus, 1758.

Type: **Acipenser sturio** Linnaeus

Acipenser Linnaeus, 1758, Syst. Nat., ed. 10, vol. 1, p. 237.
Acipenser Gouan, 1770, Hist. Pisc., pp. 12, 13.
Ichthyocolla Geoffroy, 1767, Descr. 719 plates, p. 399.
Sterleta Guldenstadt, 1772. Nov. Com. Sci. Petropol., vol. 16, p. 5333.
Sturio Rafinesque, 1810, Indice Itt. Sicil., p. 41.
Dinectus Rafinesque, 1818, Amer. Monthly Mag. Crit. Rev., vol. 3, p. 447.
Sterletus Rafinesque, 1820, Ichth. Ohinesis, p. 79.
Ellops Mindeng, 1820, Lerb. Naturg. Fische, p. 124.
Huso Brandt et Ratzeburg, 1833, Med. Zool., vol. 2, p. 3.
Helops Mutler 1834, Abh. Akad. Wiss. Berlin, 1834, p. 73.
Antaceus Heckel et Fitzinger, 1836, Ann. Wiener Mus., vol. 1, pp. 269, 293.
Schipa Brandt, 1850, Bull. Acad. Sci. Peterburg, vol. 7, p. 113.
Sinosturio Jaekel 1929, Mon. Geol. Palaeont., vol. 3, text-fig. 25.
Sturio Rafinesque, Indice Itt. Sicil., 41, 1810.
Lioniscus Fitzinger et Heckel, 1836, Ann. Wien. Mus., 370.
Antaceus Brandt, 1865, Bull. Ac. Sci. Petersb., V. 138.

Characters: Snout mostly depressed below level of forehead, partly conic. Lower lip developed only at mouth corners. Gills rather small, narrow, slender. Pseudobranchiae small. Small spiracle above eye. Caudal peduncle deeper than wide, rather short, incompletely armoured and rows of bony plates distinct to base of caudal fin. Tail not produced as filament, its tip sourounded by caudal rays.

Key to the Japanese species of Acipenser

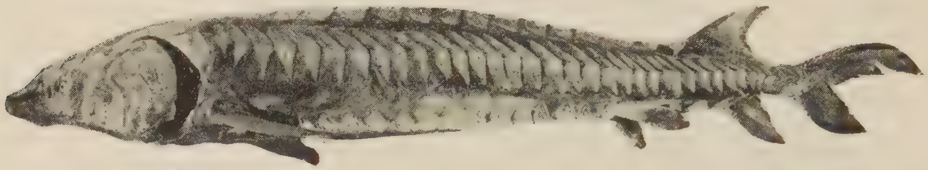
a¹. Dorsal rays III or IV, 31 to 36.
  b¹. Lateral plates 41 to 43; dorsal plates 15 or 16; ventral plates 12 to 16; anal rays 35; skin between series of scales rather smooth .... **A. multiscutatus**
  b². Lateral plates 34; dorsal plates 7 or 8; ventral plates 9; anal rays about 30; skin between series of scales with small stellate plates .... **A. acutirostris**
a². Dorsal rays III. 63; lateral plates 32; ventral plates 11; anal rays about 40; skin between series of scales nearly smooth .... **A. kikuchii**

4. **Acipenser multiscutatus** TANAKA.

"Sennin Chôzame"

(Text-figs. 32, a–b)

Acipenser multiscutatus TANAKA, Journ. Colleg. Sci. Tôkyô. vol. 23, Art. 7., p. 21, pl. 2, fig 1, 1908, (Type locality; 7 miles off Ikedohama, Iwaki, Tôkyo). – AOYAGI 1957, Gen. Notes Fresh. Fish. Japan. Archip., pp. 16–17.



a



b

Text-fig. 32. a. ***Acipenser multiscutatus*** TANAKA, after U. SAITÔ from Kakizaki coast, Niigata Prefecture, collected on August 19, 1957.
b. Ventral side of head of ***Acipenser multiscutatus*** TANAKA.

The original description* is as follows.

Acipenser multiscutatus, n. sp.

Pl. II, fig. 1.

Head 4 1/8 in total length to base of caudal; height of body 6 $^5/_8$; snout 2 $^{10}/_{11}$ in head; eye 17 $^7/_9$; interorbital 11 $^1/_6$; height of highest ray of dorsal 4; length of longest ray of pectoral 1½; upper lobe of caudal 1 $^1/_8$ times length of head; number of dorsal plates 15 to 16; of lateral plates 41 to 43; of ventral plates 12 to 16; of dorsal rays VII, 35; of anal rays VII, 28

Head longitudinally concave above; its plates rugose, without sharp prickles; snout shortish rather obtuse. Dorsal and lateral plates each with a median longitudinal ridge, without distinct spine. Dorsal plates large, rugose; a small plate lies near behind each of fourth to seventh dorsal plates. Lateral plates a little apart from one another; anterior two plates each with a small plate in front. Four or five rugose plates behind dorsal fin; three rugose plates behind anal fin; two large rugose plates in front of anal. The skin between rows of plates soft and smooth. A large plate at scapular part; directly behind it a small plate. Cheek with fine stellate prickles. Skin covered rather sparsely with very

*TANAKA, SHIGEHO, 1908: Notes on Some Japanese Fishes, with Descriptions of Fourteen New Species. (*Acipenser multiscutatus*, n. sp.). Jour. Coll. Sci. Imp. Univ., Tokyo, vol. xxii, Art. 7, pp. 21–23.

small stellate prickles, no large prickles among these. Fist two-thirds of base of anal below posterior part of base of dorsal. Distance from posterior end of base of ventral to a point vertical through origin of dorsal, a little less than the distance from posterior end of base of dorsal to caudal base.

The species besides, being much larger in size than *Acipenser mikadoi*, differs from the latter in having a much greater number of dorsal and lateral plates, smaller and less prickles on the skin, and much smaller prickles on cheek. The species differs also from *Acipenser kikuchii* in having much shorter dorsal, a somewhat more prickly skin, much more numerous dorsal and lateral plates, and a slightly finer prickles on cheek.

The type of the species, 212 cm. long to caudal base, was captured seven miles off Ukedohama, Province of Iwaki, with the plaice gill-net on May 21st, 1905. It is now preserved in the stuffed state in the museum of the Zoological Institute. It is numbered 955. Two, more or less imperfect skin of the same species purchased of a fish-merchant in Tôkyô, are contained in the Imperial Museum of Tôkyô.

Table 11. Measurements of *Acipenser multiscutatus* Tanaka.

Total length to caudal base	212. 0mm.	Highest ray of dorsal	12. 1mm.
Height of body	32. 0	Highest ray of anal	24. 0
Head	48. 0	Longest ray of ventral	17. 4
Snout	16. 5	Longest ray of pectoral	32. 0
Eye	2. 7	Upper lobe of caudal	54. 0
Interorbital	19. 0	Lower lobe of caudal	38. 0
Distance from posterior end of base of dorsal to caudal base	13. 5		

All the above measurements and description are taken from the mounted specimen in the Zoological Institute.

Table 12. Measurements of the type, before it was mounted.

Total length to caudal base	228. 5mm.	Distance from anal to caudal	10. 0mm.
Head	57. 0	Distance from posterior end of base of dorsal to caudal	17. 0
Height of body	45. 0	Upper lobe of caudal	54. 0
Snout	19. 0	Lower lobe of caudal	37. 0
Eye	2. 9	Longest ray of anal	26. 0
Barbel	6. 0	Longest ray of ventral	27. 0
Trunk (measured to vent)	124. 0	Longest ray of pectoral	32. 0
Distance from ventral to anal	24. 0		

Description: Depth $6^2/_3$ to subcaudal origin; head $4^4/_5$, width $1^3/_4$. Snout $2^2/_3$ in head, short, rather obtuse; eye $17^7/_9$; preoral length $1^7/_8$; interorbital $11^1/_6$, longitudinally concave. Dorsal plates 15 or 16, each with median longitudinal ridge, without distinct spine, large, close behind the fourth to seventh small plates 41 to 43, similar to dorsal, anterior 2 each with a small plate, in front and all well separated though without posterior small plates; ventral plates 12 to 16. Behind dorsal fin 4 or 5 rugose plates, 3 behind, 2 before anal; skin between rows of plates soft and smooth; large scapular plate with small one posterior; cheek with fine stellate prickles; chin with rather sparse, small, stellate prickles. Dorsal begins behind ends of ventrals, front edge $1^1/_2$ in head, rays VII, 35; anal begins behind middle of dorsal base, rays vii, 28; caudal $3^3/_5$ in rest of body, subcaudal $1^1/_2$ in caudal or equal to head; pectoral $1^1/_2$; ventral about 2 Length, 2, 120 mm.

Distribution: Ukedohama off Iwaki, Fukushima Prefecture (TANAKA); Naoetsu, Niigata Prefecture.

5. Acipenser acutirostris AYRES.

"Chôzame"

(Text-fig. 33)

Acipenser acutirostris AYRES, 1854, Proc. California Acad. Sci., vol. 1, p. 14. (Type locality; San Francisco). – GUNTHER, 1870, Cat. Fishes British Mus., vol. 8, p. 344. – FOWLER, 1940, Bull. 100, U. S. N. M., pp. 514–515.

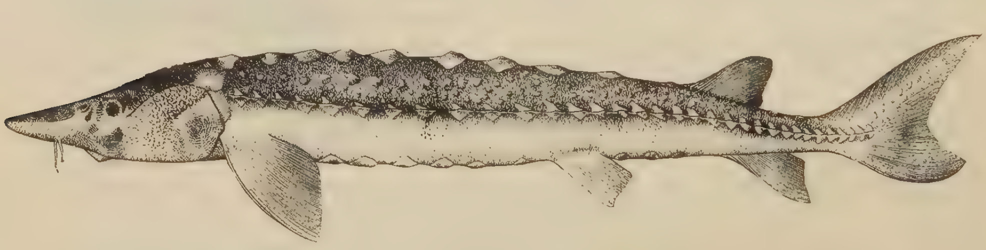
Acipenser medirostris AYERES, 1854, Proc., California Acad. Sci., vol. 1, p. 15, KIRSCH and FORDICE, 1889, Proc. Acad. Nat. Sci. Philadelphia, p. 249. JORDAN and EVERMANN, 1896, U. S. Nat. Mus. Bull. 47, pt. 1, p. 104. – BERG, 1911, Faune Russie, Poiss., vol. 1, p. 287, pl. 1, p. 104. – SOLDATOV and LINDBERG, 1937, Bull. Pacific Sci. Fisher. Inst. Fisher. Oceanogr. vol. II. p. 53.

Acipenser agassizi DUMERIL, 1867, Nouv. Arch. Mus. Hist. Nat. Paris, vol. 3, p. 181, pl. 11, fig. 2.– 1870, Hist. Nat. Poiss., Ganoides, vol. 2, p. 237.

Acipenser alexandri DUMERIL, 1867, Nouv. Arch. Mus. Hist. Nat. Paris, vol. 3, p. 183, pl. 15, figs. la-b.

Acipenser oligopeltis DUMERIL, 1867, Nouv. Arch. Mus. Hist. Nat. Paris, vol. 3, p. 184, pl. 15, fig. 2,– Hist. Nat. Poiss., 1870, Ganoides, vol. 2, p. 241.

Acipenser mikadoi HILGENDORF, 1892, Sitz. Ber. Naturf. Freunde Berlin, p. 98, – JORDAN and SNYDER, 1901, Journ. Coll., Sci. Tôkyô, vol. 15, p. 303. – SCHMIDT, 1904, Pisces Marinum Orientalium, p. 284. – JORDAN and SNYDER, 1906, Proc. U. S. N. Mus., vol. 30, p. 398. – IZUKA and MATSUURA, 1920, Zool. Spes. Tokyô Mus. Vertebrata, p. 185. – AOYAGI, 1957, Gen. Notes Fresh Fish. Japan. Archip., pp. 17–18, figs. 11–13.



Text-fig. 33. ***Acipenser acutirostris*** AYRES. $\times 1/_{10}$

The original description* is as follows:

Acipenser acutirostris, AYRES.— Length eleven inches; greatest depth, at about the fifth dorsal plate, one seventh of the length. Head one fourth of the total length. Eyes midway in the length of the head. Distance from the nostrils to the snout, one inch; breadth of the head at the nostrils, six tenths of an inch. Anterior border of the mouth beneath the eyes. Top of the head sloping forward in its whole length, until the snout becomes thin and horizontal, but it does not "shelve off suddenly before the nostrils" as in *A. transmontanus.* Plates of the body all carinate, each carina ending in a spine directed backward. The dorsal plates are the most strongly developed; the lateral series the

*Proceedings of the California Academy of Natural Sciences. 1854, vol. 1, p. 15.

least-so. Skin between the rows of plates studded with mniute stellated tubercles. Two pairs of barbels, half an inch in length, midway between the snout and the mouth. Upper lobe of the caudal fin slender, very acute, equalling the head in length. Pectorals, ventrals and anal rounded; pectorals one inch and one fourth in height; length of the anal half that of the dorsal with which fin it is coterminal. Plates of the dorsal series, in this specimen, eleven; of the abdominal, eleven on one side, ten on the other, of the lateral, fortynine. D. 45; P. 49; A. 29; V. 28; C. 22-28; *A. acutirostris* is allied to both *A. oxyrinchus*, M. the sharp nosed Sturgean of New York, and *A. transmontanus*, R. the huge species found in Columbia River. It is however sufficiently distinguished from each of them by its proportions, its bony shields &c. It is apparently quite rare in this vicinity, only two specimens having as yet been observed, the largest being about thirteen inches long.

Table 13. Measurements of *Acipener acutirostris* Ayres.

Collection	O.H.B.S.**	Collection	O.H.B.S.**
Total length	378.0mm.	Head/Interorbital width	11.80mm.
Body length	348.0	Head/Diameter of Eye	2.51
Body length/Head	3.10	Head/Length of Caudal peduncle	9.00
Body length/Depth	8.95	Head/Depth of Caudal peduncle	4.00
Body length/Predorsal length	1.31	Head/Length of Dorsal fin	6.60
Body length/Prepectoral length	3.01	Head/Length of Anal fin	4.00
Body length/Preventral length	1.59	Head/Height of Dorsal fin	4.50
Body length/Preanal length	1.19	Head/Height of Anal fin	2.24
Head/Snout	1.83	Head/Pectoral length	3.30
Head/Upper jaw		Head/Ventral length	3.59
Date	X, 1915		
Locality	Ishikari, Hokkaidô		

**Ôtsu Hydrobiological Station attached to Kyôto University

Description: Depth $6\frac{1}{2}$ to 7; head $3\frac{3}{4}$ to $4\frac{4}{5}$ in length. Snout 2 to $2\frac{1}{10}$ in head, short, rather sharp. Dorsal plates 7 or 8; laterals 34; ventrals 9. Plates well keeled, with radiating striae, rather rugose; 4 to 6 plates behind dorsal; 2 to 4 plates behind anal; sides above, between series of large plates, with 14 smaller, mostly stellate, plates, forming irregular row behind dorsal series. Dorsal rays, iv, 31 to iv, 36; anal rays, iii, 25 to iii, 28. Top of head long; cheeks with rough plates; opercle rugose. Pectoral, 2/6 in head; height of dorsal, $3\frac{1}{3}$; upper lobe of caudal, $1\frac{1}{5}$ in head. Anal rays iii, 25 to iii, 28; Length 1,200 mm.

Distribution: Hokkaidô (Hilgendorf); Hakodate (Schmidt); Yeso; Yokohama (Jordan & Snyder); River Ishikari (Izuka & Matsubara); River Ishikari, Teshio and Mikawa Streams, Hokkaidô (Jordan & Snyder); Seitohama, Fukushima Prefecture; River Ishikari, River Teshio Hokkaidô (Tanaka & Sh. Okada); Hakodate, Hokkaidô (Tanaka).

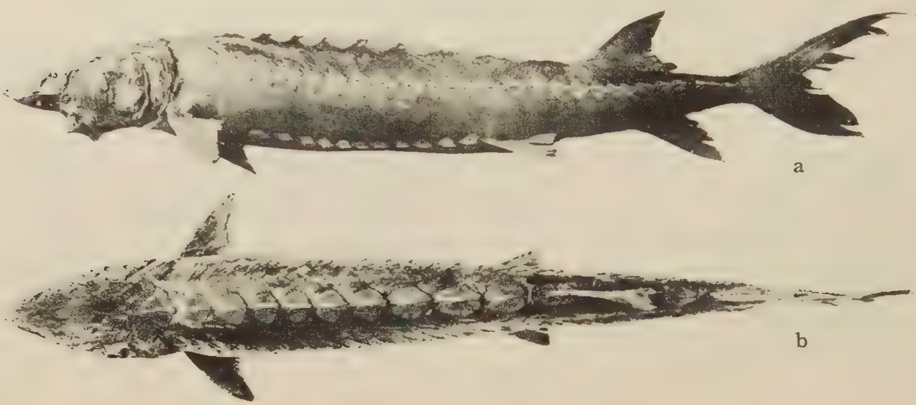
Remarks: Jordan and Snyder described from three Japanese examples in the Imperial Museum of Tôkyô, each about $1\frac{1}{3}$ meters in length, the first from the Ishikari river, in Hokkaidô, the others from streams in Teshio and Mikawa, all of these localities being in the island of Hokkaidô. This is the common sturgeon of northern Japan.

6. **Acipenser kikuchii** JORDAN et SNYDER.

"Kikuchi Chôzame"

(Text-figs. 34, a–b)

Acipenser kikuchii JORDAN et SNYDER, 1901, Journ. College Sci. Tokyô, vol. 15, p. 302, pl. 15, figs. 1-2. (Type locality, Misaki, Sagami Bay). 1906, - Proc. U. S. Nat. Mus., vol. 30, p. 397. - FOWLER, 1904, Bull. 100, U. S. Nat. Mus., pp. 515-516. - AOYAGI, 1957, Gen. Notes Fiesh Fish. Japan. Archip., p. 16.



Figs. 34. a–b ***Acipenser kikuchii*** JORDAN et SNYDER. ca. $\times ^1/_{15}$
Lateral View (upper), Dorsal view (lower).

The original description* is as follows:

Acipenser kikuchii JORDAN and SNYDER. new species. (Pl. XV, figs. 1, 2).

Head, 4 1/3 in body; depth 7; snout 2 2/3 in head. Dorsal plates, 11; lateral 32; ventral, 11. Dorsal rays III, 63; anal, III, 37.

Head longitudinally concave above; snout shortish, rather sharp. Plates of back large, rugose or warty, with on distinct spines; plates of side each with a spine in front; those below smooth. Dorsal and anal each followed by a large rugose plate. No bony plates on body except a few small ones between the large anterior ones of dorsal series. Skin of body soft and smooth between the plates. Opercle rugose. Cheeks with fine stellate prickles. Height of dorsal contained $2\ ^1/_3$ times in head. Insertion of anal below posterior part of dorsal. Pectoral contained $1\ ^3/_4$ in head. Caudal, from above, $1\ ^1/_8$ times head.

Described from a mounted specimen 180 centimeters long, in the Museum of the Imperial University, Tôkyô.

Type locality, Misaki, Sagami Bay, Province of Sagami, Japan.

The type was taken in the open se a ina net in deep water. The species is named in honor of Professor DAIROKU KIKUCHI, the distinguished President of the Imperial University of Tokyô, in recognition of his interest in scientific research.

This species is distinguished from most other sturgeons by the very long dorsal fin. Form *Acipenser mikadoi* HILGENDORF, the only other Japanese species known, it is separated by the characters in the following analysis.

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* JORDAN D. S. and SNYDER, J. O. 1901, Description of Nine New Species of Fishes contained in Museums of Japan. pp. 302-303.

Description: Depth $6\,^{2}/_{5}$ to subcaudal origin; head $4\,^{1}/_{3}$, width $1\,^{3}/_{4}$. Snout $3\,^{3}/_{4}$ in head, short, rather sharp at end; preoral length $1\,^{3}/_{4}$; interorbital $2\,^{1}/_{10}$, longitudinally concave. Head longitudinally concave above. Plates of back 11, large, rugose or warty, without distict spines; lateral plates 32, each with spine in front; ventral plates 11, smooth. No bony plates on body except few small ones between large anterior ones of dorsal series; body skin soft and smooth between plates; opercle rugose; cheeks with fine stellate prickles. Dorsal fin origin entirely behind ventrals, front edge $1\,^{4}/_{5}$ in head, with more than 6 rays; anal origin opposite last $^{2}/_{5}$ of dorsal base, front edge $1\,^{3}/_{4}$ in head, with 40 rays; caudal $4\,^{1}/_{8}$ in rest of body, front edge of subcaudal $1\,^{1}/_{2}$ in head; pectoral $1\,^{3}/_{5}$; ventral $2\,^{1}/_{6}$. Length, 1,800 mm, in the Museum of the Imperial University of Tôkyô described by JORDAN and SNYDER.

The type was captured in the open sea off Misaki and prepared as a dry specimen for the Museum of the Imperial University at Tôkyô.

It is distinguished from other sturgeons by the very long dorsal fin.

Distribution: Misaki, Sagami Bay (JORDAN & SNYDER).

Superorder Teleostei

Characters: Skeleton bony, firm. Air bladder, if present, not cellular or functional as lung, usually simple or with slender duct communicating with intestinal tract. Optic nerves crossing, not forming solid chiasma. Arterial bulb thin, with pair of opposite valves. Intestine simple, without spiral valve. Armature, when present, usually of scales of rounded design. Tail homocercal.

Order Clupeida

Characters: Soft-rayed fishes with out spine and fulcra. The anterior vertebrae simple, unmodified and without auditory ossicles; symplectic present; no interclavicles; opercular bones distinct; pharyngeal bones simple above and below, the lower not falciform. Mesocoracoid arch always well developed, forming a bridge from the hypercoracoid to the hypocoracoid. Bones of jaws developed, the maxillary broad, always distinct from premaxillary, and forming part of margin of upper jaw; no barbels. Shoulder girdle well developed and connected with the cranium by a bony post-temporal. Gills 4, a slit behind the fourth. Air bladder, if present, with a pneumatic duct. No Weberian Apparatus. Dorsal and anal fins without true spines. Ventral fins abdominal, sometimes wanting. Scales usually cycloid, sometimes ctenoid; occasionally wanting. No developed photophores. Adipose fin present or absent.

Key to the Japanese families of Clupeida

a¹ Leteral line present. Gular plate present between each ramus of lower jaw; mouth large, teeth small, pointed; maxillary scales and sheath large; dorsal median or before anal **Elopidae**

a² No lateral line. Stomach not gizzard-like. Mouth moderate, terminal; maxillary usually in 3 pieces.

b¹ Adipose fin none.

c[1] Mouth moderate, terate, terminal, the maxillary of about 3 pieces; stomach not gizzard-like .... **Clupeidae**

c[2] Mouth subinferior, very large, below a tapering, pig-like snout; maxillary very long .... **Engraulidae**

b[2] Adipose fin well-developed; oviducts none; air bladder well-developed. Stomach siphonal, not having the form of a blind sac; pyloric coeca many; branchiostegals rather numerous. Parietals separated by the supraoccipital; dorsal fin moderate, the simple rays in front few in number .... **Salmonidae**

Family Elopidae

Characters: Body elongate or oblong, mostly compressed. Mouth large, terminal, lower jaw conspicuous, lateral borders of jaws formed by maxillaries. Premaxillaries short, not protractile. Maxillary with two supplemental bones. Elongate bony gular plate between branches of lower jaw. Villiform teeth in jaws, on vomer, palatines, pterygoids, and tongue. Gill rakers rather long. Gill membranes free, separated. Pseudobranchiae present or absent. Branchiostegals numerous, over 20. Air bladder large, Scales cycloid. Belly without keels or scutes. Head naked, with collar of large thin scales around occiput. Paired fins with long, saclly axillary flaps. Lateral line straight, with simple or branched tubes. Dorsal slightly behind ventral origin. Anal far behind dorsal. Caudal forked. Pectorals low, fold like ventrals. Ventral rays 10 to 16.

Widely distributed in tropical and subtropical seas, sometimes entering freshwater. Genera few. The young pass through a metamorphosis, like the Leptocephalus stage of the eels, though easily known by their forked tails.

Key to the Japanese genera of Elopidae

a[1]. Body deep, oblong; scales large; last dorsal ray ends in filament .... **Megalops**

a[2]. Body slenderer; scales small; fins without filaments .... **Elops**

Genus Megalops Lacèpéde, 1803.

Megalops Lacèpéde, 1803, Hist. Nat. Poiss., vol. 5, p. 289.
Brisbania Castelnau, 1878, Proc. Linn. Soc. New South Wales, vol. 2, p. 241.
Tarpon Jordan et Evermann, 1896, U.S. Nat. Mus., Bull., 47, pt. 1, p. 409.

Characters: Body oblong, elongate, well compressed. Eyes large, with adipose lids. Mouth very large oblique, reaches behind eye. Teeth in jaws, on vomer, palatines, pterygoids and tongue villiform. Gill raker lanceolate. Pseudobranchiae absent. Branchiostegals 23 to 27. Scales large, tough, silvery. Anal without basal scaly sheath, though basally with smaller scales. Lateral line straight, with simple or branched tubes. Dorsal inserted little or well behind ventrals, little shorter than anal, last ray greatly elongated. Ventral rays 10 or 11. Tropical seas, entering rivers. The young pass through a long ribbon-like transparent larval stage.

7. Megalops cyprinoides (Broussonet).

"Isegoi"

(Text-fig. 35)

Clupea cyprinoides Broussonet, 1782, Ichth., no pagination, pl. 9. (type locality: Oceans between the Tropics not Japaica and Antigua or Rio Janeiro, Brazil; Tanna Island, South Pacific). – Bonnaterre, 1788, Tabl. Encyl. Ichth., p. 187, pl. 75, fig. 314. – Gmelin, 1789, Syst. Nat. Linn., vol. 1, p. 1407, Walbaum, 1792, Artedi Pisc., vol. 3, p. 40. – Bloch, 1795, Naturg. ausland. Fische, vol. 9, p. 32, pl. 403. – Schneider, 1801, Syst. Ichth. Bloch. p. 427. – Lacepede, 1803, Hist. Nat. Poiss., vol. 5, pp. 424, 458, pl. 13, fig. 3. Lichtenstein, 1844, Descr,. Anim. Forster, p. 296.

Megalops cyprinoides Swainson, 1838, Nat. Hist. Animals, Fishes, vol. 2, p. 292. – Gunther, 1868, Cat. Fishes British Mus., vol. 7, p. 471. – Bleeker, 1866–72, Atlas Ichth. Ind. Neerland, vol. 6, p. 87, pl. (12) 270, fig. 4. – Gunther, 1879, Philos. Trans. Roy. Soc. London, vol. 168, p. 471. – Schmeltz, 1879, Cat. Mus. Godeffroy, No. 7, p. 58. – Gunther, 1880, Rep. Voy. Challenger, vol. 1, p. 33, p. 37. – Macleay, 1880, Proc. Linn. Soc. New South Wales vol. 4, p. 383. – Sauvage. 1881, Bull. Soc. Philom. Paris, ser. 7, vol. 6, p. 107. – Macleay, 1881, Proc. Linn. Soc. New South Wales, vol. 6, p. 262. – Steindachner, 1883, Sitz. Ber. Akad. Wiss. Wien, math.-nat. Il., vol. 88, pt. 1. –Day, 1889, Fauna British India, Fishes, vol. 1, 402, fig. 126. – Sauvege, 1891, Hist Nat. Madagascar, Poiss., p. 497, pl. 49 a, fig. 3. – Kent, 1893, Great Barrier Reef, pp. 302, 370, pl. 45, fig. 6. – Seale, Occ., Pap. Bishop Mus., 1900, vol. 1, no. 3, p. 63,. – Jordan and Evermann, 1902, Proc. U. S. Nat. Mus., vol. 25, p. 327. –Jordan and Seale, 1905, Proc. U. S. Nat. Mus., vol. 28, p. 770. – Seale, 1906, Occ. Pap. Bishp Mus., vol. 4, no. 1, p. 63. – Jordan and Herre, 1906, Proc. U. S. Nat. Mus., vol. 31. p. 615. – Jordan and Starks, 1907, Proc. U. S. Nat. Mus., vol. 32, p. 492. – Jordan and Richardson, 1909, Mem. Carnegie Mus., vol. 4, p. 165. – Fowler, 1911, Proc. Acad. Nat. Sci. Philadelphia,. 204. – Snyder, 1912, Proc. U. S. Nat., Mus., vol. 42, p. 489. – Weber and Beaufort, 1913, Fishes Indo-Australian Archipelago, vol. 2, p. 5, fig. 4. – Weber, 1913, Siboga Exped., Fishe, vol. 57, p. 1. Nova Guinea, 1913, vol. 9, p. 515. – Chaudhuri, Mem. Indian Mus., 1916, vol. 5, p. 417. – Roughley, 1916, Fishes of Australia, p. 11, pl. 1. – Gilchrist and Thompson, Ann. Durban Mus., 1917, vol. 1. pt. 4, p. 292. – Hora, 1923, Journ. Nat. Hist. Soc. Siam, vol. 6, p. 175. Mem. Asiatic Soc. Bengal, 1924, vol. 6, p. 479. – McCullcoch and Whitley, 1925, Mem. Queensland Mus., vol. 8, pt. 2, p. 131. –Oshima, 1926, Annot. Zool. Japan., vol. 11, p. 2. – McCulloch, 1927 Fishes of New South Wales, ed. 2, p. 15, pl. 4, fig. 46a. – Schmidt, 1930, Journ. Pan-Pacific Res. Inst., vol. 5, p. 2. – Fowler, 1931, Hong Kong Nat., vol. 2, p. 49, fig. 2. –Hardenberg, 1931, Treubia, vol. 13, liver. 1, p. 99. –Herre, 1933, Journ. Pan-Pac. Res.I nst., vol. 8, No. 4, p. 6. – Roxas, 1934, Philippine Journ. Sci., vol. 55, p. 239, pl. 1, fig. 1. – Fowler, 1937, Proc. Acad. Nat. Sci. Philadelphia, vol. 89. p. 129. – Herre and Myers, 1937, Raffles Mus. Bull., No. 13, p. 11. – Fowler, 1941, U. S. Nat. Mus., Bull. 100, vol. 13, pp. 519–524. – Nichols, 1943, Nat. Hist. Central Asia, vol. 9, pp. 17–18. – Smith, 1945, Smith Inst. U. S. Nat. Mus., Bull. 188, pp. 42–43.

Elops cyprinoides Peters, 1868, Monatsb. Akad. Wiss. Berlin, p. 272.

Megalops filamentosus Lacepede, 1803, Hist. Nat. Poiss., vol. 5, pp. 289, 290, pl. 13, fig. 3, (type locality: Fort Dauphin, Madagascar). –Bleeker, 1866–72, Atlas Ichth. Ind. Neerland., vol. 6, p. pl. (15) 273, fig. 1.

Cyprinodon cundinga Buchanan-Hamilton, 1822, Fishes of Ganges, pp. 254, 283, (type locality: Salt-water esturies of Ganges River).

Elops cundinga Cantor, 1849, Journ. Asiatic Sos. Bengal. vol. 18, p. 1271. (sea and fresh water, Pinang, Malayan Peninsula).

Megalops kundinga Jeron, 1851, Madras Journ. Lit. Sci., vol. 17, p. 146. –Bleeker, 1866–72, Atlas Ichth. Ind. Neerland., vol. 6, p. 87, pl. (16), 274, fig. 1.

Megalops setipinnis Richardson, 1843, Ann. Mag. Nat. Hist., vol. 11, p. 493 (type locality: Port Essington and Coburg Peninsula). – 1846, Ichth. China Japan, p. 310, 310.

Clupea setipinna (FORSTER) VALENCINNES, 1846, Hist Nat. Poiss., vol. 19, p. 285.
Megalops setipinna BLEEKER, 1863, Nederland, Tijdschr. Dierk., vol. 1, p. 345.
Megalops curtifilis RICHARDSON, 1846, Ichth. China Japan, p. 310. (type locality: Chinese Seas).
Magalops indicus VALENCINNES, Hist. Nat. Poiss., vol. 19, p. 388, pl. 542, (type locality: Fort Dauphin, Madagascar; Mauritius; Boru; Coromande l; Pondicherry; Malabas; Alipey; Canaror; Panimbang; Java; Tahiti; Tanna.)
Megalops macrophthalmus BLEEKER, 1850, Nat. Tijdschr. Nederland. Indie, vol. 1, p. 421. (type locality: Batavia, Java).
Megalops macropterus BLEEKER, 1866, Nederand. Tijdschr. Dierk., vol. 3, p. 284, (type locality: Java, Sumatra, Singapore, Bintang, Celebles, Amboina).
Brisbani staigeri CASTELNAU, 1878, Proc. Linn. Soc. New South Wales, vol. 2, p. 241, pl. 3. (type locality: Brisbane River, Queensland).



Text-fig. 35. ***Megalops cyprinoides*** (BROUSSONET) ×¼, after BEAUFORT.

Description: Body oblong, slightly compressed, ventral profile more convex than dorsal, belly rounded. Depth $3\,^1/_8$ to $3\,^3/_4$; head $3\,^1/_4$ to $3\,^2/_5$, with 2 $2\,^1/_2$. Snout $3\,^7/_8$ to $4\,^1/_2$ in head from snout tip; eyes 3 to $3\,^4/_5$, greater than snout or interorbital, with moderately narrow adipose lid, most evident with age; maxillary reaches opposite or little beyond hind eye edge, expansion $1\,^4/_5$ to $2\,^3/_4$ in eye, length $1\,^2/_3$ to $1\,^4/_5$ in head from snout tip; interorbital $4\,^1/_4$ to $5\,^1/_2$, convex; slender gular plate $2\,^4/_5$ to 3 in head measured from tip of mandible. Gill rakers 15 to 17 30 or 31, lanceolate, $^1/_4$ longer than gill filaments, which $^1/_2$ of eye. Origin of dorsal midway between snout and base of caudal, or a little nearer to caudal, nearly twice as high as long; its upper border concave and its last ray produced into a filament. Anal concave much longer than dorsal. Ventrals below dorsal, their origin before that of dorsal and midway between anal and origin of pectoals. Villiform teeth on jaws, vomer, palatines, pterygoides and tongue. About 30 flattened gill-rakers with the innerside spinulous, a third longer than branchial filaments, about $^3/_5$ of eye.

Scales 35 to 37 in lateral line to caudal base and 3 or 4 more on latter; 5 or 6 above, 6 below, 12 to 20 predorsal. Tubes of lateral line with 3 or 4 branches. Scales thin, rather narrowly imbricated, smaller on caudal base small and crowded on anal base. Scales with about 10 to 16 basal radiating striae, reticulations medially.

Back brown, sides and below silvery white. Vertical fins and pectorals above gray to dusky, otherwise fins whitish.

Distribution: Zanzibar; East Africa; Natal; Madagascar; Rodriguez; India; Ceylon; Kalacca; East Indies; Philippines; China, Rin Rin; Japan; Formosa; Queensland; New South Wales; North Australia; West Australia; Melanesia; Micronesia; Polynesia; Thailand; Hainan.

Remarks: The present species is rather few in Japanese waters. SH. TANAKA collected a specimen at Hamana lake, Shizuoka Prefecture and described in his descriptions and figures of fishes in Japan. The authors also found the present species in Etsu lake, Kumamoto Prefecture in Kyushû.

Genus Elops LINNAEUS, 1766.

Elops LINNAEUS, 1766, Syst. Nat., ed. 12, vol. 1, p. 518.

Mugilomorus LACEPEDE, 1803, Hist. Nat. Poiss., Vol. 5, pp. 397, 398.
Trichonotus, RAFINESQUE, 1815, Analyse de la Nature, p. 88.

Characters: Body elongated. Mouth little inclined. Maxillaries very long. Fine teeth in jaws, on vomer, palatines, pterygoids, and tongue. Pseudobranchiae well-developed. Branchial stegals 27 to 34. Vertebrae 63 to 79, of which 29 caudal. Scales small, thin. Dorsal and anal both depressible in basal scaly sheaths. Paired fins each with long scaly flap. Lateral line straight, tubes simple. Dorsal slightly behind ventrals. Anal similar, smaller. Paired fins moderate. Ventral rays 17 or 18.

Large fishes of tropical or subtropical seas, sometimes entering tidal rivers. All are brilliant silvery in color.

8. Elops saurus LINNAEUS.
"Karaiwashi"
(Text-fig. 36)

Elops saurus LINNAEUS, 1766, Syst. Nat., ed. 12, vol. 1, 518. (type locality: Carolina). -CUVIER, 1817, Regene animal, 2, p. 177. -CANTOR, 1849, Journ. Asiatic Soc. Bengal, vol. 18, p. 1269. - JORDAN, 1851, Madras Journ. Lit. Sci., vol. 17, p. 146. -BLEEKER, 1866-72, Atlas Ichth. Ind. Neerland., vol. 6, p. 84, pl. (10) 218, fig. 3. -GUNTHER, 1868, Cat. Fishes British Mus., vol. 7, p. 470. -DAY, 1878, Fishes of India, pt. 4, p. 649, pl. 166, fig. 1. -SAUVAGE, 1891, Hist. Nat. Madagascar, Poiss., p. 497, pl. 49a, fig. 4. -ISHIKAWA and MATSUURA, 1897, Prelim. Cat. Fishes Mus. Tokyô, p. 8. - STEINDACHNER, 1901, Denkschr. Akad. Wiss. Wien, Math. Nat. II., vol. 70, p. 513. - JORDAN and HERRE, 1906, Proc. U. S. Nat. vol. 31, p. 616, fig. 1. - JORDAN and STARKS, 1907, Proc. U. S. Nat. Mus., vol. 32, p. 492. - JORDAN and RICHARDSON, 1908, Bul. Bur. Fisher., vol. 27 (1907), p. 235. - BOULENGER, 1909, Catalogue Freshwater Fishes Africa, vol. 1, p. 25, fig. 17. -GILCHRIST, 1931, Marine Biol. Rep. South Africa, No. 1, p. 50, pl. 2. - IZUKA and MATSUURA, 1920, Cat. Zool. Spec. Mus. Tôkyô, Vertebr., p. 184. -BARANARD, 1925, Ann. South African Mus., vol. 21, pt. 1, p. 103, pl. 6. fig. 1. -OSHIMA, 1926, Annot. Zool. Japan., vol. 11, p. 2. -FOWLER, 1941, U. S. Nat. Mus., Bull. 100, vol. 13, pp. 524-527.
Argentina machnata FORSKAL, 1775, Descript. Animal., pp. xiii, 68. (type locality: Djedda, Red Sea).
Elops machnata RUPPELL, 1835, Neue Wirbelth., Fische, p. (80) 84. - RICHARDSON, 1846, Ichth. China

Japan, p. 311. –EREBUS and TERROR, 1846, Fishes. p. 59, pl. 30, figs. 3-5. –SCHLEGEL, 1850, Fauna, Japonica, Pisces, pts. 10-15, 241, pl. 109, fig. 2. –SAUVAGE, 1891, Hist. Nat. Madagascar, Poiss p. 497, pl. 49a, fig. 4. –JORDAN and SNYDER, 1901, Annot. Zool. Japon., vol. 3, p. 52. – WEBER and BEAUFORT, 1931, Fishes Indo-Australian Archipelago, vol. 2, p. 4. –JORDAN and HUBBS, 1925, Mem. Carnegie Mus., vol. 10, p. 119. – MORI, 1928, Journ. Pan Pacific Res. Inst. vol. 3, p. 3.

Elops indicus SWAINSON, 1839, Nat. Hist. Animals, vol. 2, p. 292.

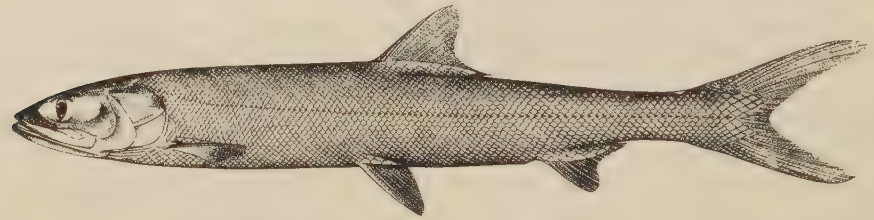
Elpos capensis ANDREW SMITH, 1849, Ill. Zool. South Africa. Fishes. pl. 7, (type locality: Cape of Good Hope). –GILCHRIST, 1913, Marine Biol. Rep. South Africa, No. 1, p. 50, pl. 2.

Elops purpurascens RICHARDSON, 1846, Ichth. China Japan, p. 311, (type locality: Chinese Seas).

Elops australis REGAN, 1909, Ann. Mag. Nat. Hist., Ser. 8, vol. 3, p. 39. (type locality: New South Wales).

Elops hawaiensis REGAN, 1909, Ann. Mag. Nat. Hist., Ser. 8, vol. 3, p. 39. (type locality: Hawaii). –JORDAN and RICHARDSON, 1909, Mem. Carnegie Mus., vol. 4, p. 165, pl. 66, upper fig. –WEBER, 1913, Siboga Exped., Fische, vol. 57, p. 1. –WEBER and BEAUFORT, 1913, Fishes Indo-Australian Archipelago, vol. 2, p. 3, fig. 2. –MCCULLOCH, 1927, Fishes of New South Wales, ed. 2, p. 15, pl. 4, fig. 45a. –FOWLER, 1928, Mem. Bishop Mus., vol. 10, p. 26. –FOWLER, 1931, Mem. Bishop Mus., vol. 11, No. 5, p. 314. –CHEVEY, 1932, Inst. Oceanogr. Indochine, 19 note, p. 8. – ROXAS, 1934, Philippine Journ. Sci., vol. 55, p. 238, pl. 1, fig. 11. –TANAKA, 1935, Fig. Desc. Fish. Japan, pp. 184–186, pl. 4, figs. 191–194.

Elops hawaiiensis FOWLER, 1918, Copeia, No. 58, p. 62. – MCCULLOCH and WHITLEY, 1925. Mem. Queensland Mus., vol. 8, pt. 2, p. 131. –HERRE, 1933, Journ. Pan-Pacific Res. Inst., vol. 8, No. 4, p. 6. –HERRE and MYERS, 1937, Raffles Mus. Bull., No. 13, p. 11.



Text-fig. 36. ***Elops saurus*** LINNAEUS. ×1

Description: Depth $4\,^4/_5$ to $5\,^1/_4$; head $3\,^1/_2$ to 4, width $2\,^2/_5$ to $2\,^2/_3$. Snout $3\,^5/_6$ to $4\,^1/_3$ in head from snout tip; eye $4\,^1/_8$ to $6\,^1/_4$, $1\,^1/_5$ to $1\,^2/_3$ in snout, little greater than interorbital in young to $1\,^1/_3$ in interorbital with age, adipose lids broad; maxillary extending far beyond eye, lower jaw included, the whole of the intermaxillary band of teeth exposed when the mouth is close; teeth in finely villiform bands in jaws, small patch on vomer and wide areas on palatines and tongue; interorbital $4\,^1/_8$ to $5\,^1/_2$, depressed or slightly concave, at least medially. Gill rakers 7 or 8 + 16 or 17, lanceolate, about $1\,^1/_2$ in eye.

Origin of dorsal much nearer to caudal than to snout. Height of dorsal about equal to its length and equal to head without snout. Anal far behind dorsal. Ventrals a little nearer to base of caudal than to tip of snout, longer than half of head, about as long as pectorals, which are a little less than half their distance from the ventrals. Their origin before origin of dorsal.

Scales 85 to 95 in lateral line to caudal base, 7 or 8 more on latter; 12 or 14 scales

above, 9 or 10 below, 38 to 46 predorsal. Scales with 13 to 18 basal striae; circuli very fine, none apical. D. v to VIII, 17, I, or 18 I, fifth to eighth simple ray $1\,^1/_2$ to $1\,^2/_3$ in totalh ead length; A. IV or V, 11, I or 12, I, fourth or fifth simple ray 2 to $2\,^3/_5$; least depth of caudal peduncle 3 to $3\,^1/_8$; pectoral $1\,^7/_8$ to 2; ventral $1\,^7/_8$ to 2; ventral $1\,^7/_8$ to 2; caudal $3\,^1/_2$ in rest of body.

Back and head above brown, sides and below bright silvery white. Fins all pale brownish. Dorsal and caudal terminally with pale brownish, fins otherwise whitish. Iris silvery white.

Distribution: Red Sea; Arabia; Zanzibar; Delagoa Bay; Natal; Cape of Good Hope; Mauritius; Reunion; Madagascar; India; Pinang; East Indies; Philippines; Hainan; China; Formosa; Japan; Korea; Queensland; New South Wales; Hawaii; Tropical Atlantic.

Remarks: The species of the present genus *Elops* has not yet been certain for their classification. In 1909, REGAN discribed 7 species from the whole world as follows.

E. saurus, *E. machnata*, *E. indicus*, *E. capensis*, *E. purpurascens*, *E. australis*, *E. hawaiiensis*.

WEBER et BEAUFORT mentioned two species *E. hawaiiensis* and *E. machnata* from the specimens of India and Australian archipelagoes and distinguished from the species of Atlantic Ocean. SH. TANAKA identified Japanese species with *E. hawaiiensis* in 1912 while in 1931 the took it under the synonyme of *E. machnata*. Furthermore, in 1933 he took all of the seven species under the synonyme of *E. saurus*. in 1940. FOWLER also identified all the species with *E. saurus* as SH. TANAKA said above in 1933. As mentioned by FOWLER in 1941, the distinctions grouping *Elops machnata* and *Elops lacerta* with "mandible projects, covers front part of premaxillary band of teeth when mouths closes" also will not hold, as many variations occur in the specimens. *Elops machnata* and *Elops lacerta* may ascertained on their fewer vertebrae 63–64, compared with 78–79 for the other species.

The present species somewhat rare in southern sea of Japan but rather more abundant than *Megalops cyprinoides*. M. NAKAMURA found the youngs after metamorphose in River Omizo, Kominato, Chiba Prefecture in the Summer of 1934.

Family Clupeidae

Characters: Body oblong or elongate, mostly compressed. Head usually compressed. Snout never prominent. Premaxillaries not protractile. Mouth rather large. Jaws usually nearly equal. Teeth small, feeble or absent. Hind lower part of opercular region often with angular emargination, tips of larger branchiostegals abruptly truncate. Gills 4, slit behind last. Gill membranes separate, free from isthmus. Pseudobranchiae present. Vertebrae 40 to 56. Ovaries with oviduct. Scales thin, loose, cycloid, sometimes pectinate. Belly rounded or compressed, always with bony serratures, with or without spines. Dorsal median or somewhat posterior, rarely absent. Anal usually somewhat long. Caudal forked. Ventrals moderate or small.

Genus **Clupea** LINNAEUS, 1758.

Clupea LINNAEUS, 1758, Syst. Nat. ed· 10, vol. 1, p. 317.
Rogenia VALENCIENNES, 1847, Hist. Nat. Poiss., vol. 20, p. 248.
Uropterina LIOY, 1865, Atti Soc. Ital. Sci. Nat. Milano, vol. 8, p. 113.
Maugeclupea WHITLEY, 1932, Rec. Australian Mus., vol. 18, p. 332.

Characters: Body elongate, compressed. Maxillary reaches below anterior or middle part of eye. Lower jaw projects, upper not notched. Teeth minute, present or absent on vomer. Opercle smooth. Lower gill rakers 34 to 51. Scales 44 to 65 in median lateral series, 12 to 16 transversely. Vertebrae 42 to 59. Dorsal rays 14 to 21, origin nearly median from snout tip and caudal base. Anal rays 14 to 23, last 2 not enlarge. Caudal folked, without enlarged scales. Ventral rays 7 to 10, inserted below or before middle of dorsal.

9. **Clupea pallasii** VALENCIENNES.
Herring, "Nishin"
(Text-fig. 37)

Clupea pallasii VALENCIENNES, 1847, Hist. Nat. Poiss., vol. 20, p. 253. (type locality: Kamtchatka). -JORDAN and HERRE, 1906, Proc. U. S. Nat. Mus., vol. 31, p. 630, fig. 4. -SNYDER, 1912, Proc. U. S. Nat. Mus., vol. 42, p. 402. -JORDAN and METZ, 1913, Mem. Carnegie Mus., vol. 6, p. 6, fig. 5. -IZUKA and MATSUURA, 1920, Cat. Zool. Spec. Tokyô Mus. Vertebrata, p. 183. -JORDAN and HUBBS, 1925, Mem. Carnegie Mus., vol. 10, p. 121. -MORI, 1928, Journ. Pan Pacific Res. Inst., vol. 3, p. 3, -AOYAGI, 1957, Gen. Notes Fresh Fish. Japan. Archip., pp. 19-20.

Clupea pallasi JORDAN et SNYDER, 1901, Annot. Zool. Japon., vol. 3, p. 53.

Clupea harengus pallasi SOLDATOV et LINDBERG, 1930, Bull. Pacific Soc. Fisher. Inst., vol. 5, p. 39, 3. -TARANETZ, Bull. Pac. Sci. Inst. Fishes. Oceanogr., vol. 11, p. 54, fig. 32, 1937.

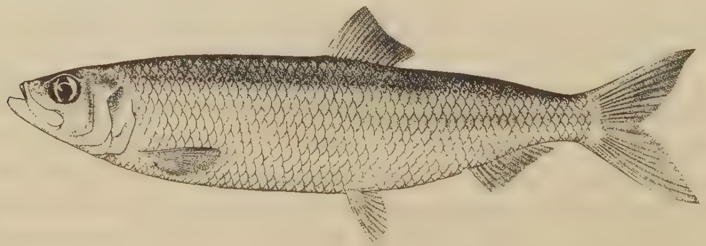
Clupea harengus subsp. **pallasii** SCHMIDT, Trans. Pacific Comm. Acad. Sci. U. S. S. R., vol. 11, p. 20, 1931 (Fusan; Vladivostok).

Clupea mirabilis GIRARD, Proc. Acad. Nat. Sci. Philadelphia, 1854, pp. 138, 154 (ype locality: San Francisco, Calif.).

Clupea inermis BASILEWSKY, 1855, Nouv. Mem. Soc. Nat. Moscou, vol. 10, p. 242, (type locality: Oriental Sea, Pekin, North China).

Spratelloides bryoporus COPE, 1873, Proc. A, er. Philos. Soc., vol. 13, p. 25, (type locality: Sitka, Alaska).

Clupea harengus (not LINNAEUS) ISHIKAWA et MATSUURA, 1897, Prelim. Cat. Fishes Mus. Tokyô, pp. 8, 9.



Text-fig. 37. ***Clupea pallasii*** VALENCIENNES. × ½ after JORDAN & HERRE.

Description: Depth $3\,^{3}/_{4}$ to $4\,^{3}/_{4}$; head $3\,^{1}/_{4}$ to $4^{3}/_{4}$; width $2\,^{2}/_{5}$ to $3^{1}/_{5}$. Snout $3\,^{2}/_{5}$ to 4 in head from upper jaw tip; eye $2\,^{1}/_{2}$ to 5, 1 tp $1\,^{1}/_{2}$ in snout, greater than interorbital; maxillary reaches $^{2}/_{5}$ to $^{1}/_{2}$ in eye, length 2 to $2\,^{1}/_{4}$ in head from snout tip, no notch in front of upper jaw medially; jaws toothless except series of minute teeth along lower maxillary edge; narrow band of minute teeth on vomer, none on palatines; interorbital $3\,^{1}/_{4}$ to $5\,^{3}/_{4}$, slightly elevated, flat medially; opercle smooth. Gill rakers 18 to 20 + 35 to 43, slender, about $^{7}/_{8}$ of eye; gill filaments $^{3}/_{4}$ of gill rakers.

Scales with 53 or 54 in median lateral series to caudal base and 4 or 5 more on latter; 13 or 14 transversely, 22 to 28 predorsal. Abdominal serrae 27 to 30 + 12 or 13. Ventral axillary flap $^{3}/_{5}$ fin length. Opercle and cheek with radiating venules. Scales with 4 to 5 transversemarginal striae above, sometimes one or several may be complete with age; circuli all transversely parallel, very fine, none apical.

D. v, 13, i, or iv, 14, i, first branched ray $1\,^{9}/_{10}$ to 2 in total head length; A. iii, 13, i or iii, 14, i, first branched ray 4 to $4\,^{1}/_{8}$; caudal $4\,^{1}/_{3}$ to $4\,^{1}/_{2}$ in rest of body, forked; least depth of caudal peduncle $2\,^{3}/_{4}$ to $2\,^{7}/_{8}$ in total head length; pectoral $1\,^{2}/_{5}$ to $1^{3}/_{5}$; ventral $2\,^{1}/_{8}$ to $2^{1}/_{2}$.

Back brown to dusky olive above, sides and below silvery white. Dorsal and caudal dusted grayish, fin otherwise whitish.

Distribution: China; Jápan; Korea; North Pacific on coasts of North America.

Remarks: According to Fujita, Kokubo (1923, 1926, 1927), Tamura (1932) and Kokubo (1938), who studied on the migration of *Clupea pallasii*, the present species are known to make the migration from the sea into the brakish water of the inland bays in the northern part of Honshû, Japan. They are called "Tominai Nishin", "Ozame Nishin", "Numa Nishin", or "Hinuma Nishin" in local and found in the lake of Tominai, Karafuto; Ozamenuma and Takakanuma, Aomori Prefecture and Hinuma, Ibaraki Prefecture. In general, those found in brakishwater have shorter heads, long dorsals, larger number of fulca and somewhat larger size than the marine ones. In the Hinuma, Ibaraki Prefecture, 3–4 aged adults begin to enter into the lake from the sea during the beginning of November and the end of March. They winter under the ice, and when the spring comes they move to the shallow water for spawning in weeds. After the spawning, they get extremely tired and descend into the sea. The youngs stay in the lake, until they grow up 50 mm. in body length and then descend into the sea during June and July. The spawning ground is located in two stations along the south and north coasts near the mouth of a lake where many *Zostera* planted on the slope from shallow to deep basin.

Family Engraulidae

Characters: Body elongate, more or less compressed covered with thin cycloid scales. Head compressed. Mouth extremely large, more or less oblique, usually overlapped by a pointed, compressed, pig-like snout. Gape very wide, the maxillary very long and

slender, formed of about three pieces, extending backward far behind the eye; in some species beyond the head. Premaxillaries not protractile, very small, firmly joined to the maxillaries. Teeth usually small, in a single row in each jaw; canines sometimes present. Eye large, well formed. Preorbital narrow. Opercles thin and membranous. Gill-rakers long and slender; Brachiostegals slender, 7–14 in number. Gill membranes separate or joined, free from isthmus. Pseudobranchiae present. No lateral line. Belly rounded or weakly separate. Fins various; the dorsal usually short and median; no adipose fin; caudal forked.

Genus Coilia GRAY, 1831.

Mystus LACEPEDE, 1803, Poiss., v, p. 406.
Coilia GRAY, 1831, Zool. Misc., p. 9.
Trichosoma SWANISON, 1839, Nat. Hist. Fishes, II, p. 292.
Chaetomus MACLELLAND, 1843, Calc. Journ. Nat. Hist., IV, p. 405.
Leptonurus BLEEKER, Verh. Bot. Gen. XXII, Madura, p. 14.
Coilia JORDAN et SNYDER, 1907, Proc. U. S. Nat. M., 31 (1499), p. 639.

Characters: Body compressed, terminating in a long tapering tail; head and mouth as in *Engraulis*; scales of moderate size. Mouth oblique. Anal fin exceedingly long, confluent with caudal; the upper pectoral rays much prolonged, filamentous; belly keeled, with thoothed scutes; premaxillary reaching to end of opercle or even to base of pectoral. Caudal pointed, united with the anal. Teeth on jaws, vomer, palatines, pterygoids and tongue. Air bladder thick-walled with two thin horns extending forward into the skull. No caninoid teeth.

Key to the Japanese species of Coilia

a^1 Number of soft rays of anal fin 75-92; Number of vertebrae 65-69: Scales on longitudinal line 60-67. .... **C. mystus**
a^2 Number of soft rays of anal fin 92-112; Number of vertebrae 75-82: Scales on longitudinal line. 71-78. .... **C. ectenes**

10. Coilia mystus (LINNAEUS).
"Etsu"
(Text-figs. 38–39, a–h)

Clupea mystus LINNAEUS, 1758, Syst. Nat., ed. 10, vol 1, p. 319. – OSBECK, 1765, Reise ost-Ind. China, p. 335. – LINNAEUS, 1766, Syst. Nat, ed. 12, vol. 1, p. 524. -BONNATERRE, 1788, Tabl. Encyclop. Ichth., p. 187, pl. 100, figs. 410. – WALBAUM, 1792, Artedi Pisc., vol. 3, p. 43.
Coilia mistus JORDAN et SEALE, 1926, Bull. Mus. Comp. Zool., vol. 67, p. 359. -TANAKA, 1933, Jap. Fish. Life colours, no. 49. -OKADA, MATSUBARA and UCHIDA, 1938, Keys Fish and Fish-like Anim. Japan, p. 42. – FOWLER, 1941, Bull. 100, vol. 13, U. S. Nat. Mus., pp. 719-721.
Mystus clupeoides LACEPEDE, 1803, Hist. Nat. Poiss. vol. 5, pp. 466, 467.
Coilia clupeoides GUNTHER, 1868, Cat. Fishes British Mus., vol. 7, p. 404. -BLEEKER, 1879, Verh. Akad. Wet. Amsterdam, vol. 18, p. 3, -STEINDACHNER, 1833, Sitz. Ber. Acad. Wiss. Wien Math-Nat. Kl., vol. 102. pt. 1, 237, -CHABANAUD, 1926, Service Oceanogr. Peches, Indo-chine I note. p. 8. -BOROIN, 1930, Bull. Vanderbilt Marine Mus., vol. 1, art. 2, p. 42.

Collia nasus TEMMINCK et SCHLEGEL, 1846, Fauna Japonica, Poiss., pts. 10–14, p. 243, pl. 109, fig. 4. GUNTHER, 1868, Cat. Fishes British Mus., vol. 7, p. 405. – Ann. Mag. Nat. Hist., ser. 4, vol. 12, p. 250. – GUNTHER, 1889, Ann. Mag. Nat. Hist., ser. 6, vol. 4, p. 219. – ISHIKAWA and MATUURA, 1897, Prelim. Cat. Fishes Mus. Tokyo, p. 9. – JORDAN and SNYDER, 1901, Annot. Zool. Japon., vol. 3, p. 54. - ABBOTT, 1901, Proc. U. S. N. M., XXII, p. 490. – JORDAN and STARKS, 1906, Proc. U. S. Nat.. Mus., 31 (499), p. 640. – FRANZ, 1910, Abh. Bayer. Akad. Wiss., vol. 4, Suppl. vol. 1, p. 5, -JORDAN and METZ, 1913, Mem. Carneg. Mus., vol. 6, no. 1, p. 8, fig. 6. – JORDAN, TANAKA and SNYDER, 1913, Cat. Fish. Japan, p. 39. – IZUKA and MATSUMURA, 1920, Cat. Zool. Spec. Tokyô Mus. Vertebrata, p. 183. – MORI, 1927, Hand List Manchurian East Mongolian Vertebr., p. 154. -NICHOLS, 1928, Bull Amer. Mus. Nat. Hist., vol. 58, art 1, p. 3. – SCHMIDT, 1931, Trans. Pacific Comm. Acad. Sci. U. S. S. R., vol. 11, p. 21.



Text-fig. 38. ***Coilia mystus*** (LINNAEUS). × 3/5

The original description* is as follows:

Coila mystus (LINN.).

Clupea. Corpus maxillarum superiorum mystacibus serratis.
Membr. branch. radius VIII: Branchiae interne setaceae.
Corpus: Abdominis carina serrata. Pinnae ventrales saepe novem radiatae.
Mystus. 8. C. corpore ensiform, pinna ani caudae coadunata.
D. 12, p. 18, V. 6, A. 84, C. 11.
Osbeck. itin. 256, *Clupea.*
Msytus. B. 10, D. 13, P. 17, V. 7, A. 86, C. 13.
Chin Lagerstr. 31. t. l. f.
12. *Mystus* corpore ensiformi. D. 12, p. 17, V. 6,
A. 84, C. 11.
Habitat in Mari Indico.
Pinna ani excurrit in pinnam caudae integram; forte
genera sub diverso comprebendi posset ?

Description: Depth 7 to $8\,^1/_2$; head $5\,^3/_4$ to $6\,^2/_5$, width $2\,^1/_4$ to $2\,^2/_3$. Snout $4\,^1/_4$ to $4\,^1/_2$ in head; eye $4\,^3/_4$ to 6, 1 to $1\,^1/_2$ in snout, $1\,^3/_5$ to $1\,^4/_5$ in interorbital; maxillary reaches slightly beyond pectoral origin; length $4\,^3/_4$ to $4\,^7/_8$ in combined head to caudal base; interorbital $2\,^3/_4$ to $3\,^1/_8$ in head, broadly convex. Gill rakers 18 to 20 + 22 or 23, finely lanceolate, equals snout, gill filaments equal $^2/_5$ gill rakers. Scales thin, rather caducous, 70 to 75 in median lateral series to caudal base; 10 transeversely, 21 to 23

* LINNAEUS, C, 1758, Systema Naturae, Tomus I, p. 319.

predorsal. Abdominal serrae 18 or 19+32 or 33. Scales with 1 to 3 basal striae joining reticulations apically; circuli very fine, concentric, feeble or absent from greater apical portion of scales. D. III, 12, 1, first branched ray $1\,^1/_{10}$ to $1\,^1/_4$ in head, also low procumbent spine anterior to dorsal origin; A. II, 100 or 102, first branched ray $2\,^7/_8$ to 3; caudal $1\,^1/_{10}$ to $1\,^2/_5$, ends in median point behind; pectoral with uppermost rays ending in 6 long filaments, reaching $1\,^1/_4$ to 3 their length to caudal base; ventral 2 to $2\,^1/_5$ in head. Back pale brownish, sides and lower surfaces silvery white. Iris white. Fins all pale brownish.

Table 14. Measurements of *Coilia mystus* (LINN.).

Collection	O. H. B. S.*		
Total length	316.0 mm.	316.0 mm.	318.0 mm.
Body length	287.0	291.0	294.0
Body length/Head	6.83	6.77	6.92
Body length/Depth	6.70	6.33	6.01
Body length/Predorsal length	4.04	4.10	4.20
Bopy length/Prepectoral length	6.78	6.93	7.00
Body length/Preventral length	4.35	4.27	4.12
Body length/Preanal length	2.39	2.41	2.41
Head/Sout	5.25	5.18	4.25
Head/Upper jaw	1.45	1.48	1·09
Head/Interorbital widtn	3.41	3.50	3.46
Head/Diameter of Eye	6.46	6.52	6.07
Head/Length of Dorsal fin	2.90	2.69	2.36
Head/Length of Anal fin	0.25	0.26	0.25
Head/Height of Dorsal fin	1.15	1.23	1.12
Head/Height of Anal fin	5.12	4.78	4.47
Head/Pectoral length	0.53	0.54	0.53
Head/Ventral length	2.30	2.27	2.34
Date	VI, 1925		
Locality	River Chikugo, Fukuoka Rrefecture		

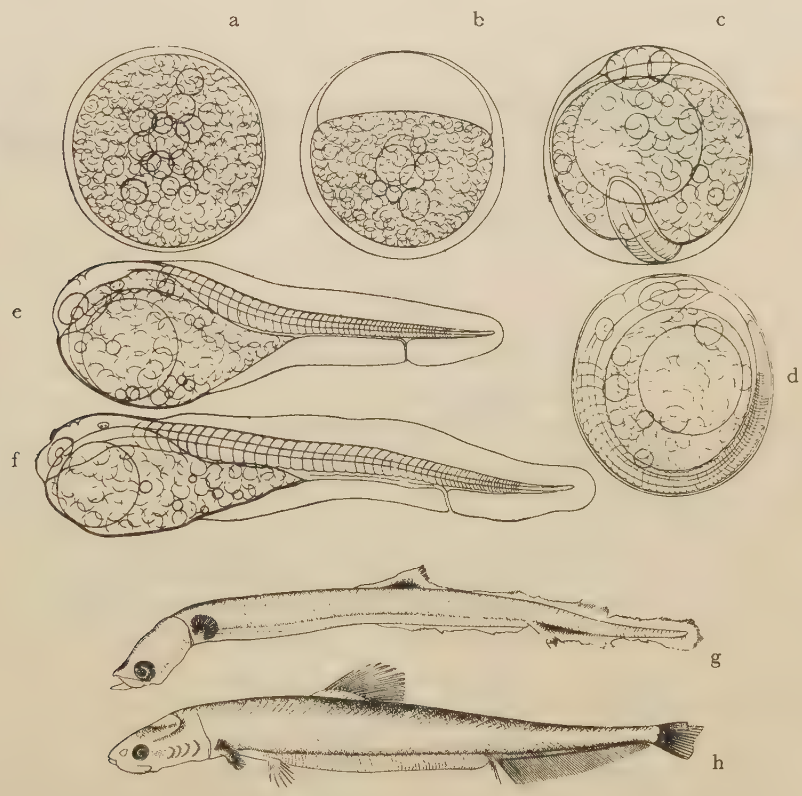
* Ôtsu Hydrobiological Station attached to Kyôto University

Distribution: Nagasaki (JORDAN, TANAKA & SNYDER); China; Shanghai; Hangchow; Nanking; Kiangin; Chinkiang; Soochow; Haimen; Chefoo; Manchuria; Port-Arther; Liao-ho; Yenkow; Antung; River Yalu; Korea, Chemulpo; Ryugan-Po; Nagasaki (SCHLEGEL) Shanghai, China (JORDAN & HUBBS), River Tikugo, Fukuoka (IKEDA; Shanghai (JORDAN & SEALE); Port Arthur (JORDAN & STARKS); Hangchow, Chuchi, Nanking (EVERMANN & SHAW); Liao-ho (MORI); Liao-ho; River Yula (MORI); Nanking (TCHANG); Soochow (SHAW); Himen (CHEN); Chefoo (WANG); Manchuria-Port Arthur (JORDAN & STARKS); Korea-Pusan; Chemulpo (JORDAN & METZ); Ryugan-po (MORI).

Remarks: On the end of April, the present species ascends into the River Chikugo River Yabe, River Hashi, River Rokkaku and River Shioda emptied into Ariake Sea. During June and August, the female spawns in the lower regions of the rivers and extremely gets tired, descending into sea or nearly going to die. Food is mostly *Acetes japonicus* K., small crustacian or other pelagic crustaceans. During the breeding season

the fish mostly does not take food.

H. YABE studied on the spawning of *Coilia mystus* (L.) during 29th of May, 1940, around Meisanri, Eizankô, Zenranandô, Korea. He described that the pelagic egg is measured 0.81–0.93 mm. in diameter, with cobalt green yolk sac contained many oil globules (more than ten). The embryo occupied about $^2/_3$ of yolk in early stage and provided with 56 myomeres just before hatching. It hatches out 32 hours under the water temperature of 20.5–21.4°c. The larva just hatching is 2.7 mm. in total length with large yolk sac contained oil globules in size of 0.6 mm. and 60 myomeres. Two days after hatching larva measures 3.3 mm. in long and provided with 67 myomeres.



Text-figs. 39. a–h. Development of ***Coilia mystus*** (LINN.) after H. YABE.

a. An unfertilized egg.
b. Blastura stage of natural egg.
c. An embryo in the egg at 16°30′ after collecting.
d. An embryo with 56 myomeres
e. An embryo just after hatching, 2.7 mm. body length.
f. A larva one day after hatching, with 67 myomeres. 3.3 mm. body lentgth.
g. Young of 7 mm. long. (after H. YOSHIDA).
h. Young of 23 mm. long. (after H. YOSHIDA).

11. Coilia ectenes JORDAN et SEALE.
"Chôsen Etsu"
(Text-figs. 40, a–c)

Coilia ectenes JORDAN et SEALE, 1906, Proc. U. S. Nat. Mus., vol. 29, p. 517, fig. 1. – JORDAN and STARKS, 1906, Proc. U. S. Nat. Mus., vol. 31, p. 516, – EVERMANN and SHAW, 1927, Proc. California Acad., Sci., ser., 4, vol. 16, p. 100. – MORI, 1927, Hand list Manchurian East Mongolian Vertebr., p. 153. – FOWLER, 1929, Proc. Acad. Nat. Sci., Philadelphia, p. 592, p. 601. – CHU, 1931, Biol. Bull. St. Joh. Univ., no. 1, p. 16. – KIMURA, 1935, Journ. Sanghai Sci. Inst., sect. 3, vol. 3, p. 104. – IKEDA, 1937, Hakubutugaku Zassi, vol. 35, no. 60, pp. 108–109, fig. 1. – AOYAGI, 1957, Gen. Nost Fresh. Fish. Japan. Achip., pp. 21–22, fig. 15.



Text-figs. 40. a–c ***Coilia ectenes*** JORDAN et SEALE. ♂ × 1/3
from Chikugo River, Fukuoka Prefecture.
Youngs of ***Coilia ectenes*** JORDAN et SEALE (after H. YOSHIDA)
b. Young of 13.5 mm. long. c. Young of 23.5 mm. long.

The original description* is as follows.

Coilia ectenes JORDAN and SEALE, new species.

Head, 5.75 in length; depth, 6.10; maxillary reaching to base of pectoral; D. I, 13; A. 123; six pectoral filaments greatly prolonged, 2.70 in length of without caudal; snout, 3.75 in head; eye, 5.10 in head; interorbital width, 3.50 in head; scales, 65 to 70.

Body elongate, compressed, tapering evenly from dorsal and ventral fins to a point at caudal; tip of snout prolonged into a short projection; upper edge of the greatly prolonged maxillary serrated; a single row of small sharp teeth in jaws and on palatines, none on vomer; gill-rakers long and slender, 26 on lower limb of outer arch; ventral surface of abdomen sharp and serrated; origin of dorsal directly in line with origin of ventrals, its base, 3 in head, its longest ray, about 1.25 in head; base of anal extending from anterior third of fish to caudal, its rays short, about 3 in head; ventrals short and

*JORDAN and SEALE, 1906, Proc. U. S. Nat. Mus., vol. 29, p. 517.

small, 2.50 in head; pectorals (not pectoral filaments) about to head, and about half the length of the filaments; caudal pointed, 3 in head.

Color in spirits, uniform silvery white; fins unmarked.

Two specimens from Shanghai, China. Length 2.30 to 3.75 inches. Type is Cat. No. 52077, U. S. N. M. Length 3.75 inches.

Description: Body elongate, compressed flattish and tapering evenly from dorsal and ventral fins to a point at caudal. Dorsal surface convexly rounded in preventral, very compressed postdorsal; ventral edge of abdomen sharply serrated. Greatest depth at origin of dorsal. Head compressed, pointed anteriorly. Mouth subterminal, opening oblique, and extending far behind of eye; cleft of mouth $1\,^4/_5$ in head. Jaws equal; maxillary greately prolonged, moderate one 5 in body (its length differe in young and adult), extending to behind base of pectoral, and lower surface serrated well. A single row of small, sharp teeth in jaws and on palatines, but none on vomer. Snout moderate, its tip prolonged into a short projection over the upper jaw. Eye anterior above of mouth-opening, $1\,^4/_5$–2 in interorbital space; hinder edge of eye nearer upper end of gill-opening than to tip of snout. Nostrils close together, in front and near of eye; posterior one larger, they separated by a thin, fieshy flap. Interorbital space broad, and its surface osseous, $1\,^1/_2$ times of snout, $2\,^5/_6$ in postorbital part of head; postorbital part of head compressed well, and thin.

Gill-openings large, extending to beyond of hinder margin of eye; gill-membranes free from narrow isthmus. Pseudobranchiae 10. Gill-rakers slender, long and lanceolate; edges finely serrated and closely set; longer than gill-filaments.

Origin of dorsal inserted forward, about the length of postorbital part of head backward from gill-opening; first branched ray the longest, a little shorter than head, $6\,^4/_5$ in body; when depressed, tips of fin extending opposite to origin of anal; its base $2\,^1/_2$ in head. Pectoral with very longer six simple rays and short, soft twelve branched rays, former more longer than three times of latter, $^1/_3$ in body, but in young shorter than this. Ventral inserted a little in advance of dorsal, short, and about 2 in head. Vent close near to origin of anal, or end of abdominal scute. Anal base very long, slightly apart from caudal fin, $1\,^3/_4$ in body length; length of ray 4 in head. Caudal peduncle very short, its depth 9 in head. Caudal fin pointed, $1\,^1/_3$ in head, its tips slightly rounded. Abdominal serration 20 or 21 + 20–23.

Scales cycloid, very thin and rather large, moderate one $1\,^1/_5$ in eye diameter, inner half with tortoise-shell patterns. No lateral line presents.

Colour in fresh, pale brownish on upper surface of dorsal, other parts silvery, lower surface with slightly blue irridescence. Dorsal and caudal fins slightly yellowish.

Remarks: Jordan and Hubbs[1)] pointed out that the specimens from near Fukuoka on the western coast of Kyûshû may be identified with *Coilia ectenes* found in China. Aoyagi[2)] recognized *Coilia ectenes* from 7 specimens collected at River Chikuma, Kyu-

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1). Jordan, D. S. and Hubbs, C. L., 1925: Mem. Carn. Mus., vol. x, no. 2, p. 122.
2). Aoyagi, Hyoji, 1957: Gener. Notes Freshwat. Fish. Japan. Archip., pp. 21–22, fig. 15.

shû. YOSHIDA[1]) reported two species of *Coilia*, *C. mystus* and *C. ectenes* are found in Ariake Sea but AOYAGI has questions for YOSHIDA's identifications and need to further investigation.

Suborder Salmonina

Family Salmonidae

Characters: Body oblong or elongate, covered with cycloid scales. Head naked. Mouth terminal, large or small, varying much in the different genera; maxillary forming the lateral margin of the upper jaw, provided with a supplemental bone; premaxillaries not protractile. Teeth various, some times wanting. Gills 4, a slit behind the fourth. Pseudobranchiae present. Gill rakers various; gill membranes not connected, free from the isthmus; branchiostegals 10 to 20. No barbels. Dorsal usually nearly median, its rays 9 to 15, only one or two of the anterior simple or rudimentary, the others branched; adipose fin present; caudal fin forked; anal fin moderate or rather long; ventrals moderate, nearly median; pectorals placed low. Lateral line present. Abdomen rounded in outline. Parietals not in contact, separated at middle by the intervention of the supraoccipital, which connects with the frontals; epipleural appendages not developed. Air bladder large, stomach siphonal; pyloric coeca very numerous. Ova large, falling into the cavity of the abdomen before exclusion.

Key to the Japanese genera of Salmonidae

a¹. The base of anal fin long, 14 to 17 developed rays; gill rakers 20 to 40; branchiostegals 12 to 16. Vomer narrow, long and flat with weak teeth .... **Oncorhynchus**

a². The base of anal fin short, of 9 to 13 developed rays; gill rakers 10 to 15; branchiostegals 10 to 14.

 b¹. Scales moderate, silvery; body covered with small, black spots; head flattened above, the jaws long .... **Hucho**

 b². Scales small, body with round, red, whitish or yellowish spots; head not depressed **Salvelinus**

Genus Oncorhynchus SUCKLEY, 1861.

Oncorhynchus, SUCKLEY, Ann. Lyc. Nat. Hist. N. Y., 1861, 312.
Hypsifario, GILL, Proc. Ac. Nat. Sci. Phila., 1862, p. 330.

Characters: Body elongate, subfusiform; or compressed. Mouth wide, the maxillay long, lanceolate, usually extending beyond the eye; jaws with moderate teeth, which become in the adult male enormously enlarged in front. Vomer long and narrow, flat, with a series of teeth both on the head and the shaft, the latter series comparatively short and weak; palatines with a marginal series on each side; teeth on vomer and tongue often lost with age; no teeth on the hyoid bone. Branchiostegals more or less increased in number. Scales moderate or small. Dorsal fin moderate; anal fin com-

1) YOSHIDA, HIROSHI, 1953: On the Specific *Coilia* found around Japan Sea and the identification of Youngs. Zool. Mag., 47 (566), pp. 784–789.

paratively elongate, of 14 to 20 rays. Pyloric appendages in increased number. Gill rakers rather numerous. Ova large. Sexual peculiarities very strongly developed; the snout in the adult males in summer and fall greatly distorted; the premaxillaries prolonged, hooking over the lower jaw, which in turn is greatly elongate and somewhat hooked at tip; the teeth on these bones also greatly enlarged. The body becomes deep and compressed; a fleshy hump is developed before the dorsal fin, and the scales of the back become embedded in the flesh.

Key to the Japanese species of Oncorhynchus

a[1] Gill rakers comparatively long and numerous (32 to 40). Scales large, 126 to 133 in a longitudinal series above the lateral line. Back in adults unspotted, clear blue in spring, red in fall; young more or less spotted in front of dorsal; landlocked examples small and more closely spotted Pyloric caeca 75 to 95 in marine fcrm and 51 to 69 in landlocked form. ... **O. nerka**

a[2] Gill rakers comparatively short and less numerous (19 to 30). Scales moderately small, 130 to 215 in a longitudinal series above the lateral line.

b[1] Scales very small, 185 to 215 in a longitudinal series above the lateral line. Branchiostegals 20 to 30; Pyloric caeca 180 to 217. Back, adipose fin and caudal fin spotted with black .... **O. gorbuscha**

b[2] Scales somewhat larger than *O. gorbuscha*, 130 to 145 in longitudinal series.

c[1] Back and upper fins with round black spots; gill rakers 13 to 18 in numbers. Dorsal fin with 11 soft rays, Anal fin 14 to 17 rays. Phyloric caeca 90 to 214, largest species of salmonoid group. .... **O. tschawytscha**

c[2] Black spots on the back of marine form quite lacking, or indistinct. Gill rakers 13 to 14.

d[1] Pyloric caeca 150 in numbers. Gill rakers 23 to 25; branchiostegals 13 or 14; Anal rays 13 or 14. .... **O. keta**

d[2] Pyloric caeca 40 55 in numbers; Gill rakers 17, dorsal fin rays 14 to 16.

e[1] Young with parr marks and red spots on the lateral sides. .... **O. rhodurus**

e[2] Young with parr marks and without red spots on the lateral sides. .... **O. masou**

e[3] Scale rather large, 120 to 139 in longitudinal line; pyloric caeca 50 to 81, Gill rakers 19 to 25; branchiostegals 12 to 15. Anal fin rays 13 to 15; dorsal fin 10 soft rays. .... **O. kisutch**

12. **Oncorhynchus nerka** (WALBAUM).

Red Salmon, "Benimasu"

(Text-figs. 41, a–b)

Salmo nerka WALBAUM, 1792, Artedi Piscium p. 71; after the *nerka* of PENNANT, the Nerka of KRASCHININNIKOW, (rivers and seas of Kamchatka). – BLOCH, and SCHNEIDER, 1801, Syst. Ichth. p. 417; after PENNANT and KRASCHININNIKOW. – BERG, 1923, Poiss. Eaux Douces Russie pp. 55-56, fig. 65.

Salmo lycaodon PALLAS, 1811, Zoogr. Rosso-Asiat., 3, p. 370. (Ochotsk Sea, Kamchatka).

Salmo paucidens RICHARDSON, 1836, Fauna Bor. – Amer.. 3, p. 222, (Columbia River).

Salmo tapdisma CUVIER et VALENCIENNES, 1848, Hist. Nat. Poiss., 21, p. 365, (Kamchatka; on a drawing).

Salmo arabatch CUVIER et VALENCIENNES, 1848, Hist. Nat. Poiss., 21, p. 365. – KANNERLYI, SUCKLEY, 1861, Ann. Lyc. Nat. Hist. N. Y. 7, 307, Chiloweyack (dwarf and landlocked), (type, No. 2092, coll. KENNERLY). – SUCKLEY, 1861, (1874), Monogr. Salmo, p. 145. – GÜNTHER, 1866, Cat. Fiih., 6, p. 120.

Salmo warreni SUCKLEY, 1861, Notices New Species N. A. Salmon, New York, and 1861 (1874) Mon-

ogr. Salmo, p. 99, (Okanogan River), (CALL, GEO GIBBS).

Salmo warreni SUCKLEY, 1861, Notices New Species N. A. Salmon, and 1861 (1874) Monogr. Salmo, p. 147, (Fraser River, British Columbia).

Salmo richardi SUCKLEY, 1861, Notices New Species N. A. Salmon, and 1861 (1874) Monogr. Salmo, p. 117, (Fraser and Skagit Rivers)

Hypsifario kennerlyi GILL, 1862, Proc. Ac. Nat. Sci. Phila., p. 330.

Oncorhynchus lycaodon GÜNTHER, 1866, Cat. Fish., 7, p. 155.

Oncorhynchus paucidens GÜNTHER, 1866, Cat. Fish, 7, p. 155.



a

b

Text-figs. 41. a. ***Oncorhynchus nerka*** (WALBAUM). ♀
b. ***Oncorhynchus nerka*** (WALBAUM). ♂

Oncorhynchus nerka JORDAN et GILBERT, 1883, Synopsis, p. 308. - SMITT, 1886, Salmonider, pp. 158, 161, pl. net v. no. 340-342. - JORDAN et EVERMANN, 1896, Fish N. and M. Amer. 1, p. 481. - JORDAN et SNYDER, 1902, Proc. U. S. N. M., 24 (1265), pp. 575-577. - EVERMANN et GOLDSBOROUGH, 1907, Bull. U. S. Bun. Fish, 26, pp. 252-258, pls. 33-36,. - KOSHIDA, 1910, Suisan Kosyûjo Sikenhôkoku, 6 (2), pp. 10-13, pl. 2. - TANAKA, 1921, Nippon Gyogaku, pp. 283-284. - JORDAN et McGREGOR, 1925, Mem. Carneg. Mus., 10 (2), pp. 126-127. - OHNO and ANDO, 1931, Suisangaku Zasshi, (34) pp. 17-18, pl. 1, figs. 1-5 (scale). - BERG, 1932, Poiss. Eaux Douces U. R. S. S.; pp. 123-126, fig. 115. - JORDAN and MATSUBARA, 1938, Nipponsan Gyorui Kensaku; pp. 44-45. - OKADA, 1938, Cat. Vert. Japan, p. 130. -OKADA and IKEDA, 1938, Daigaku, sect. B, no. 55, pp. 141. -OKADA and NAKAMURA, 1948, Nihon no Tansuigyorui, pp. 134-135, fig. 50. - AOYAGI, 1957, Gen. Notes Fresh. Fish. Japan. Archip., pp. 24-27, figs. 16-17.

? **Kunimasu**, KOSHIDA, 1910, Suisan Kenkyûsi, 5 (5), pp. 100-109, pls. 1-2.

Oncorhynchus adonis JORDAN et McGREGOR, 1925, Mem. Carneg. Mus., 10 (2), pp. 127-128, pl. fig. 2: pl. 8, fig. 4 (scale).

? **Oncorhynchus Kawamurae** JORDAN et MCGREGOR, 1925, Mem. Carneg. Mus., 10 (2), pp. 128–129, pl. 5, fig. 3; pl. 8, fig. 5 (scale). – OSHIMA, 1941, Nippon Gakudzitu Kyôkai Hôkoku, 16 (2), pp. 254–259.

The original description* is as follows:

Oncorhynchus nerka (WALBAUM) "Beni-sake"

Salmo nerka WALBAUM, 1792
Artedi Piscium, p. 71.

Russis Krasnaya ryba, i.e. piscis ruber. Pennant arct. zool. introd. 125, D. 11 P. 16, V. 10, A. 15.

Salmoni Salari forma similis, sed minor. Pondus 16 libras non superat. Avando flumina intrat colore argenteo splendet, dorso and pinnis coeruulescentibus: Dentes tunc sunt parvi & maxillae rectae. Prostea, dum inaqua dulci moratur, dentes crescunt and maxillae praesertim in maribus icurvantur. *E. mari* adscendit aestate flumina Kamtscatkae. Caro intense purpurea.

Narka. Krascheinnnikow deser, Kamtchatkae c. g. p. 181.

Caput per parvum. Rostrum breve acutum. Lingua subcaerula. Corpus parum compressum longitudine circiter 21 unciarum & latitudine 4 unc, macrolepidotum. Dorsum sabeaeruleum nigro maculatum; abdomen & latera alba. Cauda bifurca. Caro ruberrina.

Description: Head 4; depth 4, B. 13 to 15; D. 11; A. 14 to 16; scales 20–133–20; pyloric coeca 75 to 95; vertebrae 64. Gill rakers about 32 to 40, usually 14 or 15 + 22 or 23, as long as eye. Body elliptical, rather slender. Head short, sharply conic, pointed, the lower jaw included. Maxillary rather thin and small, extending beyond eye. Teeth all quite small, most of them freely movable; vomer with about 6 weak teeth, which grow larger in fall males, instead of disappearing. Preopercle very wide and convex; opercle very short, not strongly convex. Preopercle more free behind than in *O. tschawytscha.* Ventral side about half the length of the fin. Caudal fin narrow widely forked; anal fin long and low; dorsal low; Flesh deep red. Males becoming extravangantly hook-jawed in the fall, the snout being then prolonged and much raised above the level of rest of head, the lower jaw produced to meet it; mandible $1\,^1/_3$ in head in fall males, $1\,^3/_4$ in females; snout $2\,^1/_4$ in head in fall males, $3\,^1/_2$ in females. Color clear bright blue above; sides silvery, this hue overlying the blue of the back; lower fins pale, upper dusky; no spots anywhere in adults in spring; the young with obscure black spots above.

Color of breeding male: Back blood red, with dark edges to some of the scales; middle of side darker red, but unevenly so, usually darkest at middle of body; under parts dirty white, with numerous fine dark dustings; head above and on sides pale olivaceous, some darker mottling on sides; tip of nose and sides of jaws dark, under part of lower jaw white; dorsal pale red; anal darker red; adipose fin red; ventrals and pectorals smoky, some red at base. Color of breeding female essentially the same, rather darker on the sides. Length 2 feet; weight $3\,^1/_2$ to 8 pounds, Klamath and Rogne rivers northward to Kamchatka and Japan; generally abundant, especially northward; ascending streams in spring to great distances, and often frequenting. Mountain lakes in fall, spawn-

*WALBAUM, 1792, Artedi Piscium, p. 71. - BERG, 1916, Les Poissons l'eau de douce Russie, pp. 58, 59, fig. 65.

ing in their small tributaries; one of the most graceful of the *Salmonidae*, scarcely inferior to the Quinnat when fresh, but the flesh more watery and less valuable when canned.

Two distinct and widely different sizes of the Red fish are found sexually mature, the large form described above, and a small form which is mature at a foot or less in length; and no specimens of intermediate size have been observed.

Table 15. Measurements of *Oncorhynchus nerka* (WALBAUM).

Locality	Total length	Length exclusive of caudal fin	Head length	Snout length	Interorbital space	Depth caudal peduncle
Lake Akan, Hokkaidô No. 1.	mm. 294.2	242.8 mm.	4.7mm.	3.7mm.	2.9mm.	2.8mm.
No. 2.	242.1	205.5	4.0	3.5	2.8	2.4

Distribution: From Eastern coast of Hokkaidô (Muroran); Kurile Islands; Kamchatka; Alaska to Southern Part of Oregon States; Western coast of North America. Lake Akan, Hokkaidô; LakeShikotsu, Hokkaidô; Lake Towada, Akita Perfecture; Lake Chûzenji, Tochigi Prefecture; Lake Tazawa, Akita Prefecture (OKADA & NAKAMURA.), Shimushir Island (OZAKI, OKADA & KAWAMURA); Horomushir Island (OZAKI); Etorofu and Kunashir Island (NOZAWA and SOEDA).

A land-locked form "Himemasu" found in Lake; Akan and Lake Chimikep (Kitami Province), Hokkaidô. In 1894, this form was transplanted into Lake Shikotsu from Lake Akan in the beginning and at present it is introducing into Lake Dôya; Lake Towada, Akita Prefecture; Lake Tazawa; Yunoko and Lake Chûzenzi, Nikkô; Lake Haruna, Gumma Prefeture; Ashinoko, Hakone and other lakes.

In Lake Tazawa, the present species are introduced. Formely *Oncorhynchus kawamurae* ("Kunimasu" or "Kinoshirimasu" named by natives), is existed. By the observation of OSHIMA, this species are still living in lake Tazawa from Horeki age. T. KOSHIDA described in 1910 the species which closely allied to Kabachepo "Himemasu", Masu, "Sakuramasu" and "Honmasu" with somewhat differences of the characters. He has suggetted to establish a new species. JORDAN and McGREGOR (1925) named for this species as *Oncorhynchus kawamurae* as a new species. In 1931, SH. TANAKA as well as OKADA and MATSUBARA in 1938 took the new species under the synonym of *Oncorhynchus nerka.*

Remarks: Life history: The ascending and spawning seasons[1] varies by the different localities, by chiefly ascend the rivers on June to August and spawned on September to

1). According to JORDAN and EVERMANN, the beginning period of ascending the river varies on account of the rivers. It may be controled by the distance of spawning bed from the sea and the water temperature at there. In Columba river, the ascending begins March and April and they reached to the upper region of Salmon River in Idaho State where 71,000 miles far distance from the sea on June and August. In Alaska, the ascending begins just before the breeding season as the rivers are so short.

Table 16. Measurementes of *Oncorhynchus nerka* (WALBAUM).

Collection	O. H. B. S.*					
	mm.*	mm.*	mm.	mm.	mm.	mm.
Total length	256.0	288.0	314.0**	304.0**	323.0**	310.0**
Body length	219.0	243.0	274.0	264.0	284.0	272.0
Body length/Head	4.71	4.02	3.86	3.62	3.79	4.18
Body length/Depth	3.94	3.56	3.88	3.77	4.00	4.46
Body length/Predorsal length	2.17	2.18	2.08	2.03	2.09	2.13
Body length/Prepectoral length	4.87	4.43	3.81	4.13	3.90	4.46
Body length/Preventral length	1.97	1.93	1.83	1.85	1.90	1.92
Body length/Preanal length	1.36	1.39	1.42	1.40	1.45	1.42
Head/Snout	4.90	4.47	3.09	2.76	2.83	3.33
Head/Upper jaw	2.16	2.13	1.69	1.64	1.63	1.82
Head/Interorbital width	3.00	3.09	2.93	3.40	3.19	3.61
Head/Diameter of Eye	4.12	4.58	5.68	5.85	5.85	5.43
Head/Length of Caudal peduncle	1.44	1.71	1.65	1.82	1.71	1.49
Head/Depth of Caudal peduncle	2.58	3.10	3.46	3.24	3.11	2.82
Head/Length of Dorsal fin	2.00	2.20	2.13	2.36	2.41	2.01
Head/Length of Anal fin	1.94	1.92	1.82	1.94	1.97	1.71
Head/Height of Dorsel fin	1.90	1.63	1.69	1.66	1.83	1.51
Head/Height of Anal fin	2.58	2.20	2.08	2.21	2.08	1.81
Head/Pectoral length	1.44	1.39	1.42	1.46	1.32	1.35
Head/Ventral length	1.62	1.86	1.77	1.78	1.78	1.62
Date	4, IX, −1 1935					
Locality	Lake Akan, Hokkaidô		Lake Tazawa, Akita Prefecture			

*These specimens are identified with *Oncorhynchus nerka* var. *adonis* (JORDAN et McGREGOR)
**These specimens are identified with *Oncorhynchus kawamurai* JORDAN et McGREGOR.

Table 17. Measurements of *Oncorhynchus nerka* (WALBAUM).

Collection	O. H. B. S.*				
	mm.	mm.	mm.	mm.	mm.
Total length	165.0	120.0	118.0	145.0	124.0
Body length	140.0	99.0	98.0	126.0	107.7
Body length/Head	3.78	3.81	3.50	3.50	3.70
Body length/Depth	3.60	3.96	4.08	4.06	4.00
Body length/Predorsal length	2.19	2.11	2.00	2.07	2.06
Bodd length/Prepectoral length	4.00	4.13	4.08	4.20	4.30
Body length/Preventral length	1.77	1.87	1.82	1.88	1.84
Body length/Preanal length	1.40	1.41	1.44	1.42	1.36
Head/Snout	3.70	3.25	3.50	4.00	3.63
Head/Upper jaw	1.80	1.53	1.65	1.80	1.81
Head/Interorbital width	3.36	3.00	3.50	3.60	3.22
Head/Diameter of Eye	3.25	3.25	4.00	4.50	4.14
Head/Length of Caudal peduncle	1.48	1.30	1.55	1.89	1.52
Head/Depth of Caudal peduncle	2.31	2.89	2.80	2.80	2.41
Head/Length of Dorsal fin	1.54	1.00	1.12	1.90	2.25
Head/Length of Anal fin	1.85	1.62	1.65	1.71	1.61
Head/Pectoral length	1.54	1.53	1.55	1.63	1.45
Head/Ventral length	2.00	1.86	2.00	2.00	1.61
Date	VIII, 1911			19, VII, ?	
Locality	Chitose, Hokkaidô			Formosa	

* Ôtsu Hydrobiological Station attached to Kyôto University.

October. The red salmon likes to ascend the rivers with lakes and spawned . n the bed near entrance of gulf. The number of eggs 303 (body length 225 mm.) to 666 (body length 257 mm.). The fact was mentioned by MATSUI, I. and WAINAI, ICH.. (1937) from Lake Towada. Eggs are red or orange, cubical nacreous, demersal, measured 5.2-6.7 mm. in diameter (average size 6.27 mm. among 100 eggs). Larval stage: Just hatching out larva measured 20 mm. in total length. Juvenile with 42–87 mm. body length, slender and long. Length 4.8–6.0 in height. Parr marks on lateral sides rather few, numbering 7–12. Large specimen black along the margins of caudal and dorsal fins and mostly bluish white in other fins. Anal fin lower and caudal fin deeply folked. Two types are found in the present species, one descends directly into the sea after hatching out and other descends during the next spring to summer. The other peculiar type is land-locked form as it is found in lakes of Japan. They spawn at 3 to 6 ages, mostly land-locked form spawn in 4 year. (by ONO & ANDO, 1931).

Habits: They feed chiefly on zooplankton. On account of the survey at Northern Kurile Island made by SH. KAWAKAMI in 1936, *Parathemisto oblivia*, one of the Amphipod found mostly and Polychaete larva, Shrimp, Mysis, Copepod, and young fishes are also found in their stomach. The landlocked form also feeds on zooplanktons. In Shikotsu lake, *Diaptomus pacificus* var. *yesoensis* and *Daphnia longispina hyalina* in Lake Doya are observed by SAWA KENZO during 1937.

In Lake Towada, I. MATSUI and T. WAINAI found Copepods, larva of Chiromonus and shrimp in 1929.

According to the study of the food habit of *Onch. nerka*, by MARUKAWA, H. (1919) and SUEHIRO, N. (1942) most of the food is consisting of *Heteropoda*, *Shizopoda* and other small crustaceans in the sea. A land-locked form of the present species, called "Himemasu" in Japanese and "Kabatcheppu" by Ainu people, is somewhat different in the smaller size and the less numbers of pyloric caeca, (51–70) of branchiostegals, (11–13), and of depositing eggs (100–800) than of the marine form. During the day-time this form is swimming usually in the middle layer of lakes, as in Lake Sachinoko, mostly around 10 Hiro, in Lake Towada 16–22 meter in Summer. In the evening, they move up to the surface of lake to catch planktons for their food. Most of the food is consisting of *Diatomes*, *Copepods*, *Daphnians*, *Chironomus* and *Tanytarus* larvae. After hatching out, they attain sexual maturity within 4 years. During the end of September and of November, they ascend the rivers running into the lakes to spawn. The diameter of the egg is 3–4.5 mm. and the optimum temperature for hatching is 6°-9°C., according to the research made by KAWAJIRI, MINORU (1927). This one of the important edible freshwater fish transplanted into many lakes from Lake Shikotsu, Lake Akan and Lake Towada.

13. **Oncorhynchus gorbuscha** (WALBAUM).

Humpback Salmon, "Karafutomasu"
(Text-figs. 42, a–b)

Salmo gorbuscha WALBAUM, 1792, Artedi Piscium, 69. – BERG, 1923, Poiss. Russie, pp. 56–58, figs. 66–67.

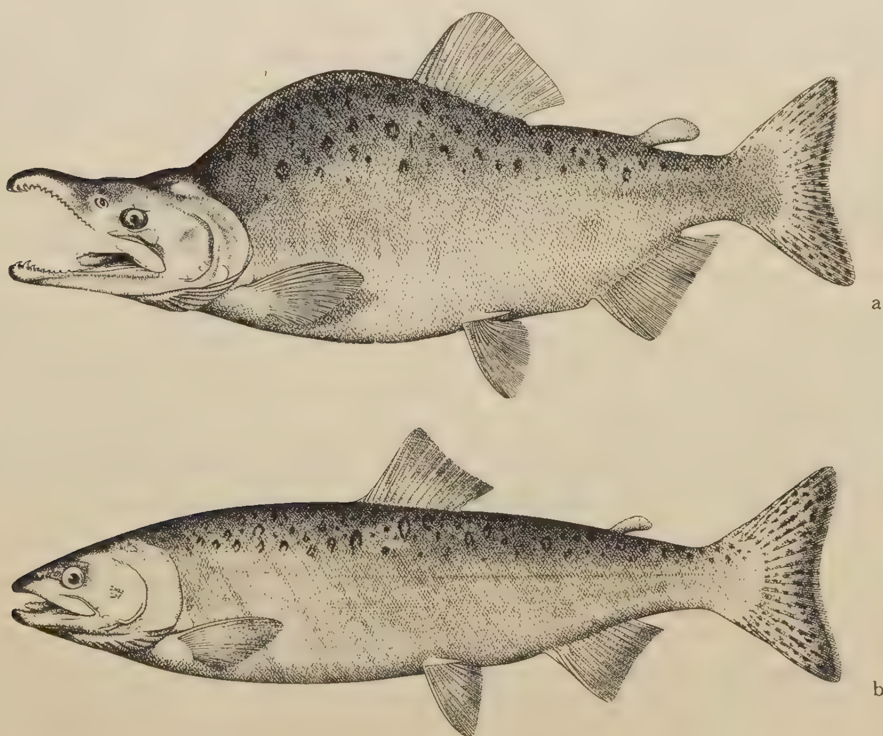
Salmo gibber BLOCH et SCHNEIDER, 1801, Syst. Ichth., p. 409.

Salmo proteus PALLAS, 1811, Zoogr. Russo-Asiatica, 3, p. 376. – SUCKLEY, 1861, (1874), Mogr. Salmo, p. 97.

Salmo scouleri RICHARDSON, 1836, Fauna Bor. – Amer., 3, p. 158.

Oncorhynchus proteus GÜNTHER, 1866, Cat. Fish. 6, p. 157.

Oncorhynchus gorbuscha* JORDAN et GILBERT, 1883, Synopsis, p. 305. – JORDAN et EVERMANN, 1896, Fishes N. and M. Amer., 1, p. 478. – JORDAN and SNYDER, 1902. Proc. Proc. U. S. N. M., 24 (1265), p.56–59. TANAKA, 1908, Annot. Zool. Jap., vol. vi, pt. 4, p. 237. – JORDAN et TANAKA, 1913, Cat. Fish. Japan, p. 42, fig. 21 – JORDAN et METZ, 1913, Mem. Car. Mus., 6 (1), p. 9. – TANAKA, 1921, Nippon Gyogaku, p. 282. – JORDAN et HUBBS, 1925, Mem. Car. Mus. 10 (2), p. 129, pl. viii, fig. 3. – MORI, 1927, Catal. Manch. Mong. Vertebrates, p. 150. – OHNO et ANDÔ, 1931, Suisangaku Zasshi, (34), pp. 18–19, pl. 1, figs. 6–8. – BERG, 1932, Poiss. U. R. SS., 1, pp. 117–122, figs. 111, 112, 112a. – OKADA, 1938, Cat. Vert. Japan, p. 130. – OKADA et MATSUBARA 1938 Nippon, san



Text-figs. 42. a-b . ***Oncorhynchus gorbuscha*** (WALBAUM)
Breeding season. ♂ (upper), ♀ (lower).

* (*gorbuscha*, the Russian vernacular name in Alaska)

Gyorui Kensaku, pp. 44–45, 46. – OSHIMA, 1940, Uwo, p. 247. – AOYAGI, 1957, Gen. Notes Fresh. Fish. Japan. Archip., pp. 27–29, figs. 19–20.

Salmo tschawytschiformis SMITT, 1886, I Riksmuseeun Befintliga Salmonider, p. 161.

Oncorhynchus masou (non BREVOORT) JORDAN et SNYDER, 1902, Proc. U. S. N. M., 24 (1265), p. 571, fig. 1.

The original description* is as follows:

Salmo gorbuscha WALBAUM, 1792: Artedi Piscium, p. 69. 30. *Salmo gorbuscha.* D. 12, P. 15, v. 10, A. 15.

Corpus sesquipedale, immaculatum, argenteum; cauda bifurca. Dorsum ante primam pinnam dorsalem admodum gibberosum. Dentes & maxillae admodum crescunt in longitudinem praesertim maxilla supera quae in initio brevior est, supra inferam senfim instar unci protenditur. Caro alba ingratum saporem habet. In Kamtschatkae fluviis aestate adscendit. Facie externa similis est *Salmoni gibboso* L. Verum differt ab illo numero minori radiorum pinnae ani & defectu macularum. Canfer. Krascheinnnikow deser. Kamtschatkae, p. 181.

Description: B. 11 or 12. Gill rakers 13 + 15. A. (developed rays) 15; D. 11; scales 215 (210–240), those of the lateral line larger, 170. Pyloric coeca very slender, about 180. Body rather slender, in the female plump and symmetrical, in the fall males very thin and compressed, with the fleshy dorsal hump much developed and the jaws much elongated, strongly hooked, and with extravagant canines in front. Ventral appendage half the length of the fin. Color bluish; sides silvery; back posteriorly, adipose fin, and tail with numerous black spots; those on the caudal fin particularly large and oblong in form; fall males red, more or less blotched with brownish.

Distribution: Northern Hokkaidô (JORDAN, HUBBS); Pacific coast and rivers of North America and Asia from Oregon northward, southward to Kamchatka, Saghkalin (JORDAN, TANAKA); Chipesani and Lake Burse (TANAKA); Ussuri, Kamchatka, Amur (MORI); Rossis (GORBUSCHA); Coraecis (KALAL); Camtchadalis (KEILUGHIN); Kuriles (SIAKIPA); Hakodate; Muroran; Kushiro; Hidaka; Nemuro; Hokkaidô (ÔNO & ANDÔ); Yufutsugawa; Shikifugawa; Urakawa, (SOEDA); Saramako, Hokkaidô (AOYAGI).

Remarks: In the breeding season, the male very flattened laterally and dorsal nipple ridge very distinctly developed. The snout very long and elongated, curved with distinct canines at the end. Body bluish on back and silvery on lateral. Many black spots on the back and on the base of adipose fin and caudal. The black spots on the caudal fin distinctly large and elliptical. In this season, the male shows red colour and spots changed into brown.

Spawning season may occur in Summer to Autumn earlier in north and later in south. OKADA SH. observed the species in River Betsutobi, Shimshir Island, one of the Kuriles spawned durring 23 to 28 of August of 1938. The spawning is carrying out in a small stream of the upper region of a river. The number of depositing eggs is mosty 1,200–1,800.

*WALBAUM, 1792, Artedi Piscium, p. 69 – BERG, 1916, Les Poissons l'eaux Douce Russie, pp. 59–62, fig. 66, 67.

Eggs are yellowish red, measured 6–8 mm. in diameter. Just hatching out larva 22.3–22.7 mm. in total length. Youngs without parr marks as shown in youngs of other species. According to ONO and ANDO (1932), the youngs mostly descends the river after hatching out and never found in land-locked form.

The youngs after hatching descend directly into the sea and stay a while in the brakish water at the mouth of the river. The young group mostly appear in tidal time and very active in the evening. The descending youngs are 34–36 mm. in body length, without parr marks. The back of the body is deep green and the belly is silver.

Two years after hatching out the present species come to sexual maturity and ascend rivers. Most of the females may die after spawning, and the more than three aged adults are very seldom.

14. **Oncorhynchus tschawytscha** (WALBAUM).
Quinnat Salmon, "Masunosuke"
(Text-figs. 43, a–b)

Salmo tschawytscha WALBAUM, 1792, Artedi Piscium p. 71,. - BLOCH et SCHNEIDER, 1801, Syst. Ichth., p. 407. - JORDAN et EVERMANN, 1896, Fishes of North America, pp. 480–481. - BERG, 1916, Les Poissons l'eau Douce Rousie, pp. 57–58, fig. 64.

Salmo orientalis PALLAS, 1811, Zoogr. Ross. - Asiat., III, pp. 367–370, pl. LXXIV.

Salmo quinnat RICHARDSON, 1836, Fauna Bor. - Amer., III, p. 219.

Fario argyreus GIRARD, 1854, Proc. Ac. Nat. Sci. Phila., p. 218.

Salmo confluentus SUCKLEY, 1858, Ann. Lyc. Nat. Hist. N. Y., - SUCKLEY, 1860, Pacific R. R. Surv., XII, part 2, p. 334.

Salmo argyreus SUCKLEY, 1860, Pacific R. R. Surv., XII, p art 2, p. 326. - SUCKLEY, 1861, Monogr. Salmo, p. 110.

Oncorhynchus quinnat, GÜNTHER, 1866, Cat., VI, 158.

Oncorhynchus chouicha. JORDAN et GILBERT, 1883, Synopsis, p. 306.

Oncorhynchus tschawytcha JORDAN et EVERMANN, 1896, Fishes N. and M. Amer., I, p. 479. - JORDAN et SNYDER, 1902, Proc. U. S. N. M., 24 (1265), pp .570–571. - EVERMANN et GOLDSBOROUGH, 1906, Bull. Bur. Fish., p. 244, pls. 29–30. - KOSHIDA, 1901, Suisan Kosyujo Shikenhokoku, 6 (2), pp. 4–9, pl. 1. - JORDAN et TANAKA, 1913, Fishes of Japan, p. 42. - JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, p, 131. - OHNO et ANDO, 1931, Suisangaku Zasshi, (34), p. 19, pl. 2, fig. 12. - BERG, 1932, Poiss. U. R. SS. I, pp. 122–123. - WATANABE, 1940, Keison Ihô, 11 (40), pp. 5–14. - AOYAGI, 1957, Gen. Notes Fresh Fish. Japan. Archip., pp. 29–30.

The original description[1] is as follows:

Salmo Tchawytcha.[2] Pennant arft. zool. introd. 124, D. 12, P. 16, V. 10, A. 15

Corpus grandiffinum latum, pondere 50 vel 60 circiter librarum immaculatum superne obscure cinereum; a lateribus argenteum pinnis e exrules albescentibus. Maxillae rectae & nunquam curvatae. Dentes magin in seriebus diversis. Squamae majores sunt, quam in Salmone communi. Cauda lunata.

[1] petri Artedi Bibliotheca Ichthyologica., Iohanne Iulio WALBAUM, 1788, p. 73.)

Additamentum [2]

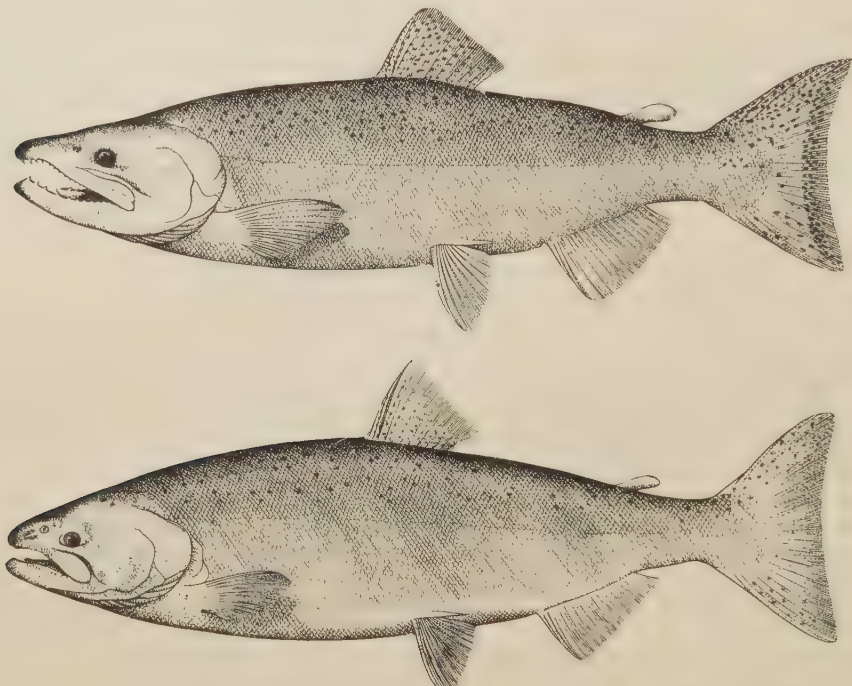
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[1] WALBAUM, 1792, Artedi Genera Piscium, p. 71.

[2] TCHAVICHE The vernacular name in Alaska & Kamtchatka.

Caro ejus, tandui in mari restat, rubra, quae in aquis dulcibus albescit. Habitat in fluminibus Kamtschatkae.

Salmoni commune similis verum multo latior est. Rostrum acutum. Maxilla supera longior infera. Opercula longa, angusta. Cauda aequnalis. Dorsum sub-caeruleum maculis nigris minimis conspersum. Latera argentea. Abdomen album. Caro & cruda & cocta rubicunda.



a

b

Text-figs. 43. a–b. ***Oncorhynchus tschawytscha*** WALBAUM. ♂ (upper), ♀ (lower).

Description: Head 4; depth 4. B. 15 or 16 to 18 or 19, the number on the two sides always unlike. D. 11; A. 16. Gill rakers usually 9+14 (i. e., 9 above the angle and 14 below). Pyloric coeca 140 to 185; scales usually 27–146–290 the number in a longitudinal series varying from 140 to 155, and in California specimens occasionally as low as 135. Vertebrae 66. Head conic, rather pointed in the females and spring males. Maxillary rather slender, the small eye behind its middle. Teeth small, longer on sides of lower jaw than in front; vomerine teeth very few and weak, disappearing in the males. In the males in late summer and fall the jaws become elongate and disorted, and the anterior teeth much enlarged, as in the related species. The body then becomes deeper, more compressed, and arched at the shoulders, and the color often nearly black. Preopercle and opercle strongly convex. Body comparatively robust, its depth greatest near its middle. Ventrals inserted behind middle of dorsal appendage half the length of the fin; caudal, as usual in this genus, strongly forked, on a rather slender caudal

peduncle. Color dusky above, often tinged with olivaceous or bluish; sides and below silvery, head dark slaty, usually profusely covered with round black spots; sides of head and caudal fin with a peculiar metallic tin-colored luster; male, about the spawning season (October), blackish, more or less tinged or blotched with dull red.

Distribution: Pacific Ocean, along the coasts of Asia and North America; Alaska; Oregon and California, ascending the Vantara River in South. Along the Asiatic coast, ascending to the river of Saghalien, Kamtchatka and somewhat south, in summer to the Pacific, north of Muroran, Hokkaidô. Toshima, Iburi; Hidaka Kushiro; Nemuro, Hokkaidô (NOZAWA).

Remarks: The female may mature in six or seven years while the male in 2 or 3 years, after hatching. Along the North Pacific Coast, the matured male and female ascend the riveris from February to March and arrive the upper regions of a river far distant from the mouth of the river. The female spawns during the end of August and October, when the water temperature goes down below 54°F. In the breeding season, the male shows blackish color and dark red spotted with coloured dots. At the spawning, the female takes off pebbles and dead leaves to make a spawning ground by digging the river basin. The spawning continues for few days and, after that, the both adults may all die by exhaustion. Eggs, measured 7.1–9.7 mm. in diameter, 8.3 mm. in average. Just hatching out larva measured 23.1 mm. in total length. The young becomes darker after 18 days of hatching out by increasenes of black pigments. Large parr marks nearly formed along the lateral lime in 30 days after hatching out. After 56–68 days, the youngs reach a length of body to 38.2–38.9 mm. and yolk sac nearly absorbed. After 77 days, when the youngs measured 42 mm. in body length, the scales are formed. The youngs hatching out stay in the river for a pretty long while and descend into the sea. The back is dark green mingled with brown. The belly is silver white and the fin colorless in some cases. The flesh of the adult appears red in spring and fades in autumn near the spawning.

During 1897, 1898 and 1917, about 100 thousands eggs were introduced into Japan from U. S. America.

15. Oncorhynchus keta (WALBAUM).

Dog Salmon, "Sake"

(Text-figs. 44, a–b)

Salmo keta vel kayko, WALBAUM, 1792, Artedi Piscium, p. 72. – BERG. 1916, Les Poissons l'eau Douce Russie, pp. 55–57, fig. 36.

Salmo lagocephalus, PALLAS, 1811, Zoogr. Ross. – Asiatica, III, p. 372.

? **Salmo japonensis,** PALLAS, 1811, Zoogr. Ross. – Asiatica, III, pp. 382–384.

Salmo dermatinus, RICHARDSON, 1854, Voyage Herald, Zool., p. 167.

Salmo consuetus, RICHARDSON, 1854, Voyage Herald, Zool., p. 168.

Oncorhychus lagocephalus, GÜNTHER, 1866, Cat., VI, p. 161.

Oncorhynchus keta, JORDAN et GILBERT, 1883, Synopsis, p. 305. – JORDAN et EVERMANN, 1896, Fishes of North America, pp. 478–479. – BERG, 1916, Les Poissons l'eau Douce Russie, pp. 55–57, fig. 63. – JORDAN et SNYDER, 1902, Proc. U. S. N. Mus., xxiv, pp. 572–574, fig. 2 – ÔTAKI, 1907, Fishes of Japan, no. 1, vol. iv – JORDAN et HUBBS, 1925, Mem. Carn„ Mus., vol. X, no. 2, pp. 129–131, pl. 8, fig. 11. – JORDAN et EVERMANN, 1896, Fishes of N. America, 1, p. 478 – EVERMANN et GOLDSBOROUGH, Bull. Bur. Fish., p. 242, pls. xxvii, xxviii – MORI, 1927, Cat. Manch. Mongo. Vertebrata, p. 150 – OKADA, 1938, Cat. Vert. Japan, p. 130 – OKADA et NAKAMURA, 1948, Nihon no Tansuigyorui, pp. 135–136, fig. 51. – AOYAGI, 1957, Gen. Notes Fresh. Fish. Japan. Archip., pp. 30–32, figs. 23–25.



a



b

Text-figs. 44. a–b. ***Oncorhynchus keta*** (WALBAUM). ♂ (upper), ♀ (lower).

The original description* is as follows:

Salmo keta VEL KAYKO WALBAUM

D. 14. P. 15. V. 11. A. 18.

Caput breve, obtusum. Corpus immaculatum. Cauda Lunata. Caro alba. Squamae argenteae. Dorsum viridescens. Capitur copiose in fluminibus Kamtschatkae.

Salmo keta VEL KAYKO, Krascheinnikow, l.c. pag. 181. Salmonem Narkam magnitudine aliquatenus superat: Caput oblongum, planum. Rostrum resimum. Dentes, post quam aliquamdin in flumine

* VEL KAYKO WALBAUM, 1792. Artedi, Piscum, p. 72. (*Keta*, a vernacular name in Kamtchatka).

moratus est, caninis similes fuint. Lingua acuta. Cauda parum bifurca. Dorsum atro-viride, latera & abdomen similiter colorata ac aliis selmonibus sed absque maculis.

Type locality: River of Kamtchatka

Description: Head 4; depth 4. D. 9; A. 13 or 14; scales about 28–150–30; B. 13 or 14, rather broad; gill rakers 9+15; pyloric coeca 140–185. General form of the Quinnat, but the head proportionately longer, more depressed and pike-like; the preopercle more broadly convex behind, and the maxillary extending considerably beyond eye. Gill rakers few, coarse, and stout, as in the Quinnat. Accessory pectoral scale short, not half the length of fin. Dusky above; sides paler, little lustrous; back and sides with no defined spots, but only fine speck, lings, which are often entirely obsolete; head dusky, scarcely any metalic luster on head or tail, caudal dusky, plain, or very finely maculate, its edge usually distinctly blackish; fins all mostly blackish, especially in males; breeding males generally blackish above, with sides brick-red, often barred or mottled. Weight about 12 pounds. San Francisco to Kamchatka, ascending all streams in the fall, and spawning at no great distance from the sea, abundant in Bering Straits. At the time of its run the males of this species are much distorted and the flesh has little value.

Remarks: Secondary Sexual Characters: – In the breeding season, both sexes show dark brownish color on both lateral sides and mottled with reddish purple irregular patterns, called "Buchi Sake" (means spotted or mottled Salmon). The posterior margin of the male's caudal fin is more black than that of the female. The snout of a male grows longer and curved, with strong large teeth end. The adipose fin of the male is somewhat larger than that of the female. According to the investigations by HONDA and KOSHIDA (1927), the sex ratio between female and male is 100:99.

Habits: The female may mature within 4–5 years and the male in about 2 years. The female deposits about 2,000–3,000 eggs at a time. The spawning season occurs in the Northern Kurile Islands in the end of August to the middle of September, and around Nemuro, from the beginning of September to the middle of November, while in Niigata from the beginning of October to the end of December. The depth of spawning ground composed of sand and pebbles is about 500–900 mm. in general. At the spawning, the female and male endeavour to make a spawning basin in 40 cm. deep and 40 cm. × 100 cm. in area with their fins. The female deposits eggs on the base of the river and then the male discharges the sperms on them and covers the eggs with sand and pebbles. After the spawning, the both sexes may die from exhaustion. Eggs are 6.7 mm. in diameter and hatch out in about 60 days under the water temperature of 8°–10°C. The larvae, with yolk sac are buried under the sand of the spawning ground in a short period. The youngs stay around the spawning ground till the next April and May when the snow melts and they descend into the sea after staying in the mouth of the river for a while. The youngs of this stage measure about 60 mm. in body length with small elliptical or round parr marks. On the back, there are found small black round patterns cattered irregularly. The main food of the young is consisting of larvae, pupae and

adults of insects, pelagic copepods, together with some algae. The adult which is living in the sea, takes Amphipoda, Pteropoda, Schizopoda, young crabs, Polychaeta, and young fishes as his food in natural (MARUKAWA, 1919 and SUEHIRO, 1942).

In the breeding season, the male is black on head, somewhat bluish below the orbit and pinkish behind the orbit. Belly bluish dark and with black spots on the back and pink on the ventral with bluish mottled pattens transversely. Caudal fin light black and with faint black spots on the upper fin rays. Dorsal fin light black and with black rod-like spots. Black spots on the adipose fin. Anal fin light black and pink along the base. Ventral also light black and pink innerside.

According to JORDAN and EVERMANN (1937), the spawning season is somewhat later compared with that of *Oncorhynchus gorbuscha*. In the south of Puget Sound, the spawning season may continue from the beginning of September to the beginning of November.

The youngs measured 42–88 mm. in total length, mentioned by OKADA and KAWAMURA (1938), the total length about 4.2–4.9 in body height and have 9–13 parr marks on the laterals. The anterior edge of anal fins and upper margin of the back shows distinct white. The caudal fin shallowly folked.

Distribution: This is the common large salmon of Japan, everywhere known as "Sake" or "Shake", exceedingly abundant in Hokkaidô, extending its range southward as far as the River Tone, Chiba Prefecture, north of Tôkyô. Pacific coast of Northern Pacific; Alaska; Kamtchatka; River Bettobu, Shimshir, Northern Kurile (OKADA, KAWAMURA 1938), River Horobetsu, (OKADA), River Mena, a branch of River Shiribetsu (OKADA). Hakodate, Hokkaidô; Aomori; River Tone (JORDAN, HUBBS); Bering Sea. American Coast (JORDAN); Hakodate; Same; Noto (JORDAN, SNYDER); Ishikari River; Northern Hondô; River Tone (OTAKI); Tomanko, Kainei Korea (MORI); Amur (PALLAS).

16. Oncorhynchus kisutch* (WALBAUM).

Silver Salmon, Kisutchi, "Ginmasu"

(Text-fig. 45)

? **Salmo milktschitch** WALBAUM, 1792, Artedi Piscium, 70 – BERG, 1916, Les Poissons l' eau Douces de la Russie, pp. 54-55, fig. 62.

Salmo kisutch WALBAUM, 1792, Artedi Piscium, 70.

? **Salmo striatus** BLOCH et SCHNEIDER, 1801, Syst. Ichth., p. 407.

Salmo kysutch BLOCH et SCHNEIDER, Syst. Ichth., p. 407.

Salmo sanguinolentus PALLAS, 1811, Zoogr. Ross. -Asiat., 3, p. 379-381, pl. ixxx.

Salmo tsuppitch RICHARDSON, 1836, Fauna Bor. – Amr., 3, p. 224. – Amer., 3, p. 224. – GÜNTHER, 1866, Cat., 4, p. 118.

Oncorhynchus lycaodon GÜNTHER, 1866, Cat., 4, p. 155 (in part).

Salmo scouleri SUCKLEY, 1861 (1874), Monogr. Salmo, p. 9 4.

Oncorhynchus sanguinolentus GÜNTHER, 1866, Cat. 6, p. 160.

Oncorhynchus tsuppitch JORDAN, 1880, Forest and Stream, sept. 16, p. 130. – JORDAN et SNYDER 1887, Proc. U. S. N. M., xxiii, no, 1213, p, 349.

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* *Kisutch*, the vernacular name in Alaska & Kamtchatka.

Oncorhynchus kisutch JORDAN et GILERET, Synopsis, p. 307. –JORDAN et EVERMANN, 1896, Fish. N. & M. Amer., p. 480. –JORDAN et SNYDER, 1902, Proc. U. S. N. M., 24 (1265), pp. 574–575. –KOSHIDA, 1909, Suisan Kosyûjo Sikenhôkoku, 6 (2), pp. 14–17, pl. 3. ? –TOKUHISA, 1931, Suisankenkyûshi, 8 (10), pp. 439–440. –JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x. no. 2, p. 131. –OHNO et ANDO, 1931, Suisangaku Zasshi, (34), pp. 19–20, pl. 2, fig. 13. –OZAKI, 1936, Bull. Jap. Soc. Sci. Fish. 4 (5). –JORDAN et EVERMANN, 1937, Amer. Food and Game Fishes. -OKADA, 1938, Cat. Vert, Japan, p. 130. -OKADA et KAWAMURA, 1938, Botany and Zoology, 6 (5), pp. 851-857. -OKADA, 1939, Zool. Mag., 51 (4), pp. 207-215, figt. 1-4. -OKADA, 1939, Botany, and Zoology, 7 (4), pp. 113-114. -AOYAGI, 1957, Gen. Notes Fresh. Fish. Japan. Archip., pp. 39-40, fig. 31.



Text-fig. 45. ***Oncorhynchus kisutch*** (WALBAUM). ♂

The original description is as follows:

Salmo kisutch WALBAUM*

D. 11. P. 14. V. 10. A. 14.

Facie extrna Salari similis est, sed in longitudinem truim pedum nunquam excrescit. Color argenteus circa dorsum maculatus. Maxillae longae obtusae. Dentes magni. Caro rubra antequain lacum reliquit, in fluminibus antem aestate albescit. Habitat aestate in fluviis, dehinc in lacum versus hyemen revertitur.

Description: Head 4; depth 4. B. 13 or 14. Pyloric coeca very few and large, 63 (45 to 80); gill rakers 10 + 13, rather long and slender, nearly as long as eye, toothed; scales 25–127–29. D. 10; A. 13 or 14. Body rather elongate; compressed. Head short, exactly, conical, terminating in a bluntly pointed snout, which is longer and broader than the lower jaw; head shorter than in a young Quinnat of the same size. Interorbital space broad and strongly convex. Opercle and preopercle strongly convex behind; the preopercle very broad, with the lower limb little developed; cheeks broad. Eye quite small, much smaller than in young Quinnat of the same size. Suborbital very narrow, with a row of mucous pores along its surface; maxillary slender and narrow, but extending somewhat beyond the eye. Teeth very few and small, only two or three on the vomer; those on tongue very feeble. Pectorals and ventrals short, the ventral appendage three fifths the length of the fin; caudal strongly forked, on a slender peduncle. Bluish green; sides silvery, with dark punctuations; no spots except a few rather obscure on

*WALBAUM, 1792, Artedi Genera Piscium p. 70.

top of head, back dorsal fin, adipose fin, and the rudimentary upper rays of the caudal; rest of the caudal fin unspotted; pectorals dusky tinged; anal with dusky edging; sides of head without the dark coloration seen in the Quinnat; males mostly red in fall, and with the usual changes of farm.

Color silvery, with dark points and a few rather faint dark spots on top of head, back, dorsal fin, adipose fin, and upper rays of caudal; caudal unspotted below; dorsal fin

Table 18. Measurements of *Oncorhynchus kisutch* (WALBAUM).

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total length	300.0mm.	Head/Interorbital width	2.97mm.
Body length	255.0	Head/Diameter of Eye	5.20
Body length/Head	4.90	Head/Length of Caudal peduncle	1.36
Body length/Depth of body	4.46	Head/Depth of Caudal peduncle	2.60
Body length/Predorsal length	2.19	Head/Length of Dorsal fin	1.89
Body length/Prepectoral length	5.00	Head/Length of Anal fin	1.69
Body length/Preventral length	1.98	Head/Height of Dorsal fin	1.68
Body length/Preanal length	1.59	Head/Height of Anal fin	2.40
Head/Snout	4.41	Head/Pectoral length	1.41
Head/Upper jaw	2.28	Head/Ventral length	1.76
Date	17, V, 1935		
Locality	Ôtsu, Shiga Prefecture		

*Otsu Hydrobiological Station attached to Kyôto University.

more or less tipped with dusky; pectorals and anal dusky; breeding males mostly dull red, the head not black; no red on on young examples.

Type locality: Rivers and Lakes of Kamchatka.

Distribution: The present species is widely distributed in the northern Pacific, Kurile Islands; Shimushir Island (SH. OKADA, KAWAMURA); Etorofu Island (ÔNO, ANDO); Horobestu River and Shiribetsu River (SH. OKADA),

Remarks: Secondary sexual characters: In the breeding season, the male has a strongly lengthened and curved snout. The color also changes in male. A red stripe crosses along the middle of opercle from the posterior end of eye. The upper part of the lateral line to belly is deep reddish and greenish irregular patterns across the lateral. The bases of ventral and anal fins are red.

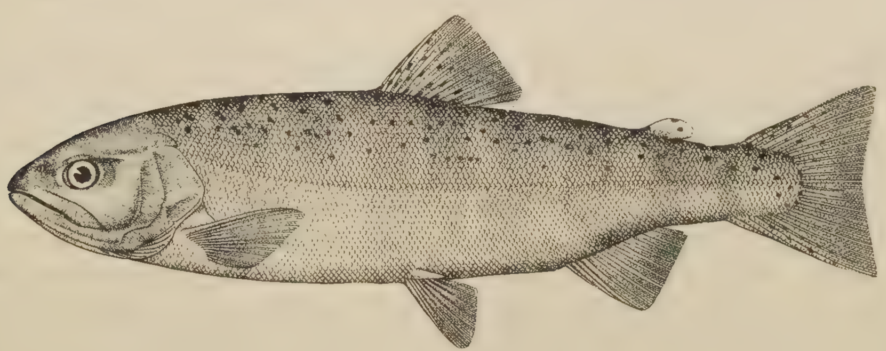
Habits: In the Kurile Islands and Alaska, the present species ascends the rivers during the middle of August and the middle of September and begins to spawn at the end of October. The spawning ground is located somewhat far from the mouth of river, and not far distance as seen in other salmonid fishes. After hatching out, some of the youngs pass the freshwater life during one year and descend the river into the sea and the others stay for two years in freshwater and then descend into the sea. The descending youngs have each a black mark on the distal end of dorsal fin and large parr marks. The color is yellowish brown, with metalic luster on the lateral and silver on the belly. The posterior margin of the anal fin is invaginated; the first soft ray is white and lengthened.

The both sexes mature within 3–4 years. The food of descending youngs consists of Dipterian insects and small Crustacians, *Orchestia* and *Gammarus*.

17. Oncorhynchus masou BREVOORT.

"Yamabe Masu, Sakuramasu, Yamabe (dwarf form), Yamame (land locked form)"
(Text-fig. 46)

Salmo masou BREVOORT, 1856, Narrative of an Expedition to China and Japan, vi, p. 275, pl. ix, fig. 2. – BERG, 1916, Les Poiss. l'eaux Douce. de la Aussie pp. 52–54, figs. 60–61.
Salmo macrostoma, GÜNTHER, 1880, Chall., Report Zool, I, p. 71, pl. xxxi, fig. A.
Salmo perryi JORDAN et SNYDER, 1902, Proc. U. S. Nat. Mus., pp. 578–580, vol. xxiv, n. 1265 – TANAKA, 1908, Annot. Zool. Japan., VI. p. 238.
Onchorhynchus yessoensis HILGENDORF, 1876, Monatsber. Ges. Ost. Asien, XI, p. 25.
Oncorhynchus masou (BREVOORT), 1902, Proc. U. S. Nat. Mus., vol. 24, no. 1265, pp. 571–532, fig. 1 – UI, 1932, Kishû Gyofu, pp. 64–65. –OKADA, 1938, Cat. Vert. Japan, p. 130. – OKADA et IKEDA, 1931, Saitô Hô-onkai Mus. R. Bulletin no. 15, p. 87 –OKADA et NAKAMURA, 1948, Nihon no Tansuigyo, p. 137, fig. 53. –AOYAGI, 1957, Gen. Note Fresh. Fish. Japan. Archip., pp. 35–38, figs. 29–30.
Oncorhynchus ishikawae JORDAN et MCGREGOR, 1925, Mem. Carneg. Mus., x, no. 2, p. 132, pl. vi, fig. 1.



Text-fig. 46. ***Oncorhynchus masou*** BREVOORT. ♀

Description: Head 4 in length; depth 4; depth of caudal peduncle $3\,^1/_8$ in head; snout $4\,^2/_3$; eye 7; maxillary $2\,^1/_5$; D. 13; A. 15; scales in lateral series about 190; between lateral line and insertion of dorsal about 29. Interorbital space convex, $3^1/_4$ in length of head; maxillary extending considerably beyond eye; gill rakers long, 9 + 15 to 18; branchiostegals 13. Teeth on jaws weak, a few very small ones on palatines and vomer. Vomer with seven or eight sharp teeth. Opercle and preopercle strongly convex behind; caudal fin forked, strong and short, contained about 5 times in the length; pectoral $1\,^2/_3$ in head; ventral $2\,^1/_5$; the ventral appendage almost two-thired the length of fin; adipose fin large.

Coloration rather dark; sides silvery; tip of dorsal and inside of pectorals, and vent-

rals blackish. Pyloric caeca few, not over 40 to 50. Dorsal and caudal with some black spots; back with spots; spots along base of dorsal.

Color and pattern in formalin somewhat silvery, dorsal part grayish; pearl marks rather obscure and small; dorsal fin anteriorly with a large blackish blotch; adipose and caudal fins marginally dusky.

Table 19. Measurements of *Oncorhynchus masou* BREVOORT.

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total length	190.0mm.	Head/Interorbital width	3.08mm.
Body length	158.0	Head/Diameter of Eye	4.35
Body length/Head	4.27	Head/Length of Caudal peduncle	1.37
Body length/Depth of body	4.79	Head/Depth of Caudal peduncle	2.84
Body length/Predorsal length	2.22	Head/Length of Dorsal fin	1.76
Body length/Prepectoral length	4.39	Head/Length of Anal fin	1.95
Body length/Preventral length	1.87	Head/Height of Dorsal fin	1.95
Body length/Preanal length	1.39	Head/Height of Anal fin	2.18
Head/Snout	3.90	Head/Pectoral length	1.68
Head/Upper jaw	1.80	Head/Ventral length	1.85
Date	XII, 1915		
Locality	Kasumigaura, Ibaraki Prefecture		

* Ôtsu Hydrobiological Station attached to Kytô University.
** This specimen is identified with *Oncorhynchus* var. *ishikawae masou* (J. et MCGREG.).

Distribution: Marine form is distributed in the Kurile Islands, the east and western coasts of Sagkhalien and the middle of Honshû. On the Pacific coast of Japan, they are found abundantly far north of the River Tone. From the River Kiso (NIWA); Inland sea coast of Hyôgo Prefecture (ÔUYE); Off Tosa (KAMOHARA); On the Japan Sea coast, River Takatsu, Shimane Prefecture (AOYAGI); River Chikugo (AOYAGI); off Kumamoto (MATSUBARA) are reported. Landlocked form is nearlly equally distributed as in marine form; in the district from the south of the River Fuji (TANAKA) and the south and west of the eastern part of Yamaguchi Prefecture along the Japan Sea coast, "Amago" is mostly found instead of "Yamame". "Yamame" is found in the upper river of Daikokei, Formosa, 1,700 meter above the sea level. The water temperature at this station 14.9°–17.2°C. in summer was examined by M. OSHIMA (1936). In the Lake Biwa, the present species is found together with *Oncorhynchus rhodurus*. Perhaps this was introduced from Hokkaidô in 1922 and then has grown wild.

River Kiso (NIWA); Coast of Inland Sea (OKAMI); off Tosa, Kôchi Prefecture (KAMOHARA); River Kozu, Shimane Prefecture (AOYAGI); River Chikugo, Kumamoto Prefecture (AOYAGI); off Kumamoto Prefecture (MATSUBARA); River Fuji, Shizuoka Prefecture (TANAKA). Hokkaidô; Honshû; Shikoku; Kyushû; Maritime; Amur; Kankyodo, Korea; Aomori Prefecture; Yamagata Prefecture; Iwate Prefecture; Miyagi Prefecture (OKADA & IKEDA).

Remarks: It is a well-known fact that the present species of Japan proper is devided into two races, the land-locked one ("Yamabe") and the sea-run form ("Masu"). The

land-locked fishes usually in habit the mountain streams, but these fishes, seem to go astray to the mouth of the river in a snowflood, in the northern provinces. The author obtained landlocked specimen at River Ishikari, the River Sikaribetsu, and River Abashiri, and one sea-run specimen from Lake Abashiri.

JORDAN & THOMPSON mentioned that the present species close to *Oncorhynchus kisutch* of Alaska and is common as far south as Lake Biwa and sometimes landlocked, as in Lake Chûzenji, where it has been artificially introduced from Akita. Secondary sexual characters: The male has longer head and snout than female. In the breeding season, the snout strongly lengthened and the teeth more sharply pointed. STEWART (1894), ISHII (1916) and DE BEER (1924) reported the hermaphrodite of the trout. The male is less in number than the female.

Habits; –According to ÔNO (1933), the present species lived in Hokkaidô, the female mature in 3–4 years and the male in 2 years after hatching out. In there, the fish ascend the rivers in May. At that time, the gonad is not yet ripened and the fish tries to get food after ascending into the river. The fish, arriving at the upper river, gets a ripened gonad and shows a peculiar sexual color. The spawning bed is located in 30–60 cm. of depth with pebbles in a clear current. The female digs a long, narrow and concaved, hole and deposits about 2,500 eggs and the male discharges sperms and then covers the eggs with sand. After the spawning, male and female may be dead from exhaustion. The eggs hatch out in 60 days after fertilization under the water temperature of 8°C. and in natural may hatch out in 3 months after spawning. The hatched larva hides under sand and grows gradually obsorbing the yolk sac. The youngs of 3 mm. in size swim out of the spawning ground, when they are greyish brown with well-developed parr-marks on the body. When the youngs grow into 80–90 mm. in body length during July and August, the male changes the color into black, exhibiting in the breeding season, while the female has unripened eggs. Newly hatched youngs migrate into unfrozen water or spring water to winter. In the next May, the fish show a silver belly and indistinct parr mark on the lateral. The back is dark blue and the end of dorsal fin deeply black. The body changes into slender, long in form and each fin shrinks, scale easily taken off. This fish is called "Ginge Yamame"-Silver trout. This swims actively and grows rapidly by taking in much food. During the middle of May and the end of June, they gradually descend into the sea and swim in the open sea. Most of the males may have matured till the spring of the second year and few of them change into "silver trout" with unripened testis as shown in the female of silver trout. The sea-run fish includes silver trout, male and female, and the ordinal male changes into landlocked form called "Yamame". The silver trout descends into the sea and stays in suitable without large migration. After one year, they come close to the coast for breeding in the next May under the water temperature of 5°–12°C. After descending into the sea, the fish take much animal food as shown in *Oncorhynchus nerka* and *O. keta*. Landlocked trout has the characteristic of parr marks all the life, without black patterns on the distal end of dorsal fin nor form the scale a spawning mark, fixed with skin. In two years, they grow about 200 mm. in body length. During April and May, the body shows golden luster on the lateral and silver on belly, while in summer and autumn, the color and luster disappearing it becomes black. The male matures in one year while the female in three years. The number of eggs contained in one female is calculated 200–380. The diameter

of an egg is 0.5 mm., with orange yolk. The food is consisting of pelagic Crustaceans:– Copepods, Cladocera, Ostracoda, and aquatic insects, as well as fish egg.

18. **Oncorhynchus rhodurus** JORDAN et MCGREGOR.

"Biwamasu, Amenouwo"

(Text-fig. 47)

Oncorhynchus masou JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. 6, no. pp. 211-212, pl. 24, fig. 3.

Oncorhynchus rhodurus JORDAN et MCGREGOR, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 137-139, pl. 7, fig. 1, pl. 8, figs. 1-2. -OKADA, 1938, Cat. Vert. Japan, p. 130 -OKADA et NAKAMURA, 1948, Nihon no Tansuigyorui, p. 136, fig. 52. - AOYAGI, 1957, Gen. Note Fresh. Fish. Japan. Archip., pp. 32-35, figs. 26-28.

The original description is as follows:

Oncorhynchus rhodurus JORDAN and MCGREGOR, sp. nov.

(Plate VI, fig. 1; Plate VIII, figs. 1-2.).

The type of this well marked species is a mature male 20.25 inches long (Collector's No. 2218) (Car. Mus. Cat. Fishes, No. 7794) with very strongly hooked jaws and nuptial colors, taken in Lake Hakone, Sagami, November 20, 1923, presented by Mr. HENRY KANAYA YAMAGUCHI, proprietor of the noted Fujiya Inn at Miyanoshita.

This specimen shows the following characters: body robust, compressed; jaws much hooked, the long upper jaw overlapping the lower; anal fin of moderate height, first ray fully reaching to middle of last ray; tip of first few rays produced; caudal subtruncate or shallowly lunate; anal rays 12; branchiostegals 11-12; gill rakers $8+10=18$ (very short); pyloric coeca 42; vertebrae 63; scales 133, (in poor shape from absorption), structurally of a modified *O. kisutch* type, showing a few reticulations, at least six circuli completely surrounding focus, these much more widely spaced posteriorly; at least in its fourth year 21 to 31 circuli in all on exposed area.

Color in life: Head jet-black; sides bright greenish, with only a few black spots, these chiefly confined to the back. Parr-shades faint, the interspaces pink, contrasting with the green of the sides; no red stripe along sides; a bright red stripe along outer rays of caudal above and below, fading in spirits to whitish, that on the lower rays most distinct; black spots on dorsal numerous, small, more or less oblong and oblique; spots on base of fin few, oblong and obliquely set; tips of dorsal, anal, and ventrals broadly creamy white; pectorals with obscure dark edging distally; caudal lobes short, acute, a few black spots above and below: inside of mouth blackish, one vomerine tooth remaining.

A microscopic study of the scales of No. 2136 (a paratype thirteen inches in length) reveals that the individual was seven years old and had never spawned before. This equals the maximum longevity hitherto recorded for *Oncorhynchus*.

Three female specimens, ripe with eggs, about a foot long, from Lake Hakone (November 20) are much smaller and slenderer; dull soot-silvery in color with traces of dark spots above, and faint pinkish shades in the interspaces, alternating with traces of dark bars. Upper and lower edge of caudal pale, but (in spirits) no longer red; numerous smaller oblong, oblique spots, arranged vaguely in rows along the rays, those at base of the fin oblong, oblique, ink-like, sometimes running together in a broken line; caudal with a few dark scattered spots; none on ventrals or pectorals; paired fins dark, with abrupt yellowish white tips.

A younger male is like the old one, but less brightly colored and barely beginning to be hooknosed. It has still a long row of five small vomerine teeth.

Two spawning females, (from some locality in Shinshû) one about a foot in length, and one about 17.5 inches long, excluding ova, are dusky metallic-sooty, with traces of dark bars, these quite unlike the rounded parr-marks of other species; no red on fins, except on lower ray of caudal; spots mostly obliterated; anal with a broad white tip; adipose fin with a dark spot above; anal usually with a few dark spots at base; no series of dark spots along side below lateral line in either specimen.

Parr-marks mostly early replaced by broad vertical dark cross-bars, which in the males tend to grow sharper with age; pectorals deep slaty, as are also the other lower fins, except for the pale tipes; young without red spots on sides. The faint broad dark cross-shades are characteristic of this species.

Of *Oncorhynchus rhodurus* we have six examples of various sizes and both sexes from Lake Hakone, and two from some lake in Shinshû, near Nagano. The species may be known at sight by the pale dorsal as well as by the absence of dark spots below the lateral line. A much more important character is found in the presence on each scale of many (21 to 31, the average 25.4) unbroken circuli on the exposed part of the scale. In *Oncorhynchus macrostomus* and *O. ishikawae*, the unbroken circuli on the posterior surface are few (7 to 10, averaging 8) and the spotting is different.

In spite of resemblance to *Salmo*, this is a true *Oncorhynchus*. Like *Salmo*, it has twelve anal rays, mostly eleven or twelve branchiostegals, seventeen to twenty gill-rakers, and one hundred and thirty-three scales in lateral series. The fact that the first anal ray reaches beyond the middle of the last ray marks most of our species of *Salmo*. On the other hand. the number of coeca (averaging) 57), the number of vertebrae (about 63), but more particularly the well developed hooked nose in the ripe males, and the death of all spawning individuals, identify it as an *Oncorhynchus*.

Oncorhynchus rhodurus is the species figured by JORDAN and THOMPSON, Mem. Car. Mus., VI, 1913, p. 211, pl. XXIV, fig. 3, as *Oncorhynchus masou*. The specimen figurred, Car. Mus. Cat. Fishes, No. 6002a, was taken in Lake Chiusenji, a landlocked mountain lake, in which it was said to have been introduced from Akita in Ugo in the northwestern part of Japan. We were told that all individuals in the lake die after spawning. The figure in question accurately represents a young male, except that the black spots have faded.

A specimen from Naoetsu, Echigo, is in the Stanford University Museum, collected by K. OTAKI.

The following table gives the record of our various examples.

Table 20. Tabular summary of Characters of *Oncorhynchus rhodurus* JORDAN et McGREGOR.

	Coeca	Gill-rakers	Anal Rays	Branchio-stegals	Scales number	Vertebrae number	Head pr. ct. in length	Maxillary pr. ct. in length
Range	42–76	17–20	12–13	11–13	124–133	62–63	29–33	19–22
Mean	57.4	18.6	12.4	11.8	128	62–7	24–25	13–14

Description: Body robust, compressed; jaws much hooked, the long upper jaw overlapping the lower; anal fin of moderate height; first ray fully reaching to middle of last ray; tip of first few rays produced; caudal subtruncate or shallowly lunate; anal rays 12; branchiostegals 11–12; gill rakers 8+10=18 (very short); pyloric coeca 42; vertebrae 63; scales 133, structurally of a modified *O. kisutch* type, showing a few reticulations, at least six circuli completely surrounding focus, these much more widely spaced posteriorly; at least in its fourth year 21 to 31 circuli in all on exposed area.

Distribution: The present species are distributed in the middle and western parts of Honshû. The northern limit is the Doshi River, a branch of the Sagami River on the

* D. S. JORDAN and C. L. HUBBS, 1925. Record of Fishes obtained by D. S. JORDAN in Japan, 1922. pp. 137–139.

Pacific coast, while on the Japan Sea Coast, the eastern part of Yamaguchi Prefecture. They are also distributed in many rivers along the Seto Insland Sea coast, Shikoku and Kyushû; the southern limit occurs in the River Yonazu and the River Sendai of Kagoshima Prefecture. The present species of Lake Biwa have been transplanted into many



Text-fig. 47. Male ***Oncorhynchus rhodurus*** J. McGREG. in breeding season.

rivers of Fukui Prefecture, Tottori, Shimane Prefectures and other places. Yamaguchi Prefecture (TANAKA); River Komenotsu, River Sendai, Kagoshima Prefecture (OGAWA); Lake Biwa (TANAKA); Lake Chûzengi, Nikkô (TANAKA); Fukui Prefecture; Tottori Prefecture; River Kôzu, Shimane Prefecture (AOYAGI).

Remarks: Secondary sexual characters: Male has longer head and jaws than female. In the breeding season, the upper and lower jaws of male are found elongated and strongly curved.

Habits: The sexual maturity may arrive in 3–5 years and after the breeding, both male and female may be dead. The depositing number of egg is 800–3,000 in average. The breeding season varies in local. Around Lake Biwa it occurs during the middle and the end of November and in the River Kino district of Wakayama Prefecture from the end of October to the beginning of November while in Kôchi and Saga Prefectures, from biginning of October to the beginning of November. In the Lake Biwa, the fish begin to ascend the rivers at the beginning of the breeding season and ready to spawn on the basin composed of sand and pebbles. The diameter of an egg is 4.2–5.1, 6.7 mm. According to MIYAZAKI (1928), the egg hatches out in 30–35 days under the water temperature of 12°–15°C. and 37 days under 9°, after fertilization. The just-hatching-out larva is 13.5 mm. in body length and absorbs the yolk sac in 22–23 days under the water temperature of 19°C. The so-called "Amago" is a young of the present species and provided with the scattered beautiful red spots on both sides of the body. In summer, the youngs live in the upper river under the water temperature of 20°C., but when the winter comes, the water temperature going down, they are found in the middle of the river. The food is mostly consisting of aquatic insects.

Table 21. Measurements of *Oncorhynchus rhodurus* JORDAN et MCGREGOR.

Collection	Fish. Mie Univ.*		Fish. Mie Univ.*		
Total ength	199.0mm.	185.5mm.	149.0mm.	188.2mm.	212.0mm.
Body length	16.70	157.8	123.0	162.2	180.0
Body length/Head	3.55	3.61	3.77	4.37	3.78
Body length/Depth	4.23	4.19	3.94	4.70	4.05
Body length/Predorsal length	2.06	2.22	2.12	2.42	2.19
Body length/Prepectoral length	4.01	4.00	4.21	4.76	4.28
Body length/Preventral length	1.82	1.98	1.89	2.21	1.82
Body length/Preanal length	1.35	1.45	1.40	1.66	1.35
Head/Snout	3.29	4.28	3.68	3.52	3.56
Head Upper jaw	1.64	1.68	1.70	1.61	1.61
Head/Interorbital width	3.53	3.24	3.26	3.14	3.34
Head/Diameter of Eye	4.61	4.61	4.53	4.11	5.03
Head/Length of Caudal peduncle	1.93	1.79	1.74	1.66	1.72
Head/Depth of Caudal peduncle	2.98	3.00	2.81	2.84	2.93
Head/Length of Dorsal fin	1.88	1.71	1.79	1.90	1.71
Head/Length of Anal fin	2.22	1.96	2.22	2.14	2.08
Head/Height of Dorsal fin	1.55	1.73	1.54	1.61	1.64
Head/Height of Anal fin	2.04	2.23	1.89	1.90	1.99
Head/Pectoral length	1.51	1.55	1.37	1.39	1.40
Head/Ventral length	1.90	1.99	1.84	1.74	1.75
Date	IX, 1955		VIII, 1955		
Locality	River Kumozu, Mie Prefecture		River Machiya, Mie Prefecture		

* Faculty of Fisheries, Prefectural University of Mie

Genus **Hucho** GÜNTHER, 1866.

Hucho GÜNTHER, 1866, Cat. Fish., vol. 6, 125.

Characters: Body slender, elongate, the head pike-like, with vertical sides, and flattened snout and frontal region; mouth large; vomer as in *Salvelinus*, the shaft depressed below the head and without teeth; palatine teeth strong; strong teeth on the tongue, none on the hyoid region; scales silvery, large or small, the body marked with small black dots; anal fin short; branchiostegals 12, gill rakers few.

19. **Hucho perryi** (BREVOORT).

String-fish, "Ito-uwo"

(Text-fig. 48)

Salmo perryi BREVOORT, 1856, Exped. Japan, p. 273, pl. 9, fig. 1 – GÜNTHER, 1866, Cat. Fish. Brit. Mus., vol. 6, p. 122.

Salmo blackistoni HILGENDORF, 1876, Monatsber. Gesellschaft Ostasien, p. 25 – ISHIKAWA, 1897, Prel. Cat., p. 21.

Hucho blackistoni JORDAN et SNYDER, 1902, Proc. Nat. Mus., vol. 24, no. 1265, pp. 580-581, fig. 3 – TANAKA, 1921, Nihon Gyogaku, p. 285.

Hucho perryi, JORDAN, TANAKA et SNYDER, 1913, Journ. Coll. Sci. Tokyô Univ., vol. 33, art 1, p. 43, fig. 23. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 145-146, pl. 8, fig. 7. – TANAKA, 1932, Gyoruigaku, p. 86, fig. 7. – MORI, 1936, Stud. geograph. Dist. Freshwat. Fish Eastern Asia, p. 11 – TARANETZ, 1937, Bull. Pacif. Sci. Inst. Fish & Oceanogr. tome 2, vol. 11, p. 65 – OKADA, 1938, Cat. Vert. Japan, p. 130 – OKADA et MATSUBARA, 1938, Keys Fish & Fish-like

Anim. Japan, p. 46 – OKADA et NAKAMURA, 1948, Nihon no Tansuigyo, pp. 139–140, fig. 56. – AOYAGI, 1957, Gen. Note Fresh. Fish. Japan. Archip., p. 41–42, fig. 33.



Text-fig. 48. ***Hucho perryi*** (BREVOORT). ca. × 1/3

The original description* is as follows:

Notes. – From Hakodadi, May and June (33 inches), D. 11, A 11, P. 15, C. 25.

After a careful comparison of this figure with all the species of salmon from the Pacific described by PALLAS in his Zoographia, or by VALENCIENNES in the 21st volume of the Histoire des Poissons, this fish would seem not to have been described before. It resembles the *S. purpuratus* of PALLAS in some points, and may be an adult specimen of it; but the Pacific salmon are not well known, and no one species has been placed on a sure basis. PALLAS, RICHARDSON and VALENCIENNES describe some twenty-five distinct species from the Pacific, which number will probably be reduced considerably. The surveying expedition to the North Pacific, under Commander JOHN RODGERS, has brought home 550 species of fish, among which many Salmonidae must occur; and these collections will probably assist in clearing up the confusion now existing in this group.

The *Salmo* herewith figured has been named after the able commandor of the United States Japan Expedition, to whose efforts alone we owe the scantly yet interesting zoological collections and drawings, made under disadvantageous circumstances, while the squadron was in those distant seas.

In its general form and coloring it sembles the *Salmo hamatus* of Europe, and the New Brunswick salmon of North America, and no doubt is the representative of that type in the Pacific, the figure having probably been taken from a female.

Head large and thick, four and a half times in total length of fish. Jaws very strong and thick, the upper one rather pointed, with stout curved maxillaries, the lower one longest when depressed, with a strong curve upwards. Teeth strong and recurved. Profile from snout to occiput nearly straight, curving thence gently into the dorsal outline, which is straight also to behind first dorsal. Abdominal outline not prominent, but gently tapering to base of caudal. Height of body in front of dorsal 5/6 of length of head; at base of caudal 1/3 of same. Eyes small, 1/12 of head. Opercles rounded, branchial rays stout. Scales distinct and rather large, but two distinctly marked in the engraved figure. Lateral line straight. Fins large, with pointed lobes. Anterior base of dorsal slightly nearer to snout than to margin of caudal. Second dorsal large, for the fish. Pectorals long and pointed. Anal under adipose dorsal. (Both these fins seem, in the drawing, to be too near to the base of the caudal.) Caudal with broad pointed lobes, posterior margin deeply emarginated and intented at the centre.

Proportions, from the original drawing, in hundredths of total length, measuring from snout to centre of margin of caudal:

Colos: Dusky along the back of head, and becoming blue on the opercles, and dirty white beneath. Margin of lower jaw bluish dusky. Back of head, snout, opercles and maxillaries, covered with round,

* JAMES CARSON BREVOORT, 1856. Notes on some Figures of Japanese Fish taken from recent Specimens by the Artists of the U. S. Japan Expedition, pp. 273–274, pl. IX, fig. 1.

Height of body of pectorals	18. 00 mm.	Base 1st to base 2d dorsal	31. 00 mm.
Height in front of dorsal	19. 00	Second dorsal long	5. 00
Height at base of caudal	7. 00	Snout to base ventrals	53. 00
Snout to margin opercle	22. 50	Ventrals long	16. 00
Snout to orbits	7. 50	Base ventrals to base anal	25. 00?
Diameter of orbits	2. 00	Anal long	14. 00
Pectorals long	15. 00	Snout to end scales on lat. line	95. 00
Snout to first dorsal	46. 00	Lobes of caudal	16. 00
Anterior rays long	17. 00	Emargination of open caudal	6. 00

irregular sized blackish spots, rather closely set. Eye golden yellow. Back dusky, soon however fading into dirty purplish red on the sides, which on the under parts fades again into dirty white. The dusky back and colored sides are covered with blackish spots of irregular form, smaller than those of the head and rather more sparsely distributed. Lower part of dorsal spotted also. This and all the other fins are of a brownish black of rather uniform hue, the caudal inclining to brown. Ventrals and anal of a lighter shade, with their anterior rays lighter still.

Type locality Hakodadi (Hakodate, Hokkaidô).

Description: Head 3.33 in length to end of last vertebra; depth 5; depth of caudal peduncle $3\,^1/_4$ in head; eye 6.75 in head; interorbital space $4\,^1/_2$; snout 3.75; maxillary 2; depth of caudal peduncle 2. D. 10; A. 9; Scales in lateral series 109, in transverse series $18+17$; pores in lateral line 97. Body long and low, not much compressed, the mouth large. Head long, low, broad, pike-like, quadrangular in section; interorbital area broad, slightly convex; maxillary extending a little beyond eye. Dentition peculiar; only vomer with a short transverse series of teeth, none. Teeth small, those on lower jaw longest; no teeth on shaft of on vomer, even in the young; tongue with a row of sharp teeth on each edge. Height of dorsal 1.66 in head; pectoral fin 1.75; anal 2, caudal deeply forked, 1.5 in head, ventral appendage about one-third as long as the fin. Dorsal rays 11, anal rays 10, pectoral 14; gill rakers rather short and stout, $8+12=20$; branchiostegals 12–12; pyloric caeca 157, short, densely imbricated, the largest only 8 mm. long by 1.5 thick. Vertebrae 57 $(51+6)$. Scales rather large, the entire surface marked with concentric circuli, about one-seventh of those of the concealed surface not continued on exposed area, resulting a slightly wider spacing on this part.

Color silvery, dark above, the head and body usually profusely covered with small, brownish spots; dorsal fin with a few at its base.

Remarks: Jordan and Snyder. identified the specimen from Lake Biwa with *Salmo perryi* by his description of a black spotted trout may be provisionally identified as *Salmo perryi*. But from our observations, that may be included under the name of *Oncorhynchus rhodurus* distributed in Lake Biwa. The spawning season is somewhat different in localities. In Lake Kucharo, Hokkaidô, it is carried out during April and May while in Ogawaranuma, Aomori Prefecture during February and March. The spawning habits are unresearched yet. This fish mostly lives in the lower water, found in lakes and bays along the seacoast all the year. When the snow melts in spring, they ascend into the rivers open to bays and lakes, to spawn. The sea-run form is not yet discovered. The present species is distributed in Hokkaidô, Kurile Island and Saghalien. The sou-

Table 22. Measurements of *Hucho perryi* (BREVOORT).

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total length	mm.	Head/Interorbital width	3.22mm.
Body length	326.0	Head/Diameter of Eye	6.07
Body length/Head	4.13	Head/Length of Caudal peduncle	1.84
Body length/Depth	4.47	Head/Depth of Caudal peduncle	2.82
Body length/Predorsal length	2.25	Head/Length of Dorsal fin	2.28
Bodylength/Prepectoral length	4.28	Head/Length of Anal fin	2.63
Body length/Preventral length	1.75	Head/Height of Dorsal fin	1.98
Body length/Preanal length	1.41	Head/Height of Anal fin	2.02
Head/Snout	4.16	Head/Pectorsal length	1.68
Head/Upper jaw	2.11	Head/Ventral length	2.19
Date	VIII, 1951		
Locality	Hokkaidô		

thern limit is Ogawara Numa, Aomori Prefecture (AOYANAGI). Kunashiri Island and Etrofu Island (SOEDA). Aomori Pref., Iwate Pref., Aomori, Hokkaidô (TANAKA): Aomori (MORI): Hakodate (BREVOORT): Northern part of Japan (OKADA, MATSUBARA):, Hokkaidô (HILGENDORF): Hokkaidô, Southern Saghalien, Aomori (JORDAN, TANAKA SNYDER): North from Morioka (TANAKA): Kushiro, Neumero, Chishima, Settsu, Shifto River, Hokkaidô, Heigun-River, Rikuchu, near Morioka (JORDAN & SNYDER): Naoetsu, Echigo (TANAKA, HUBBS).

Habits: This string-fish is found in rivers and streams of northern Japan, rather common in Hokkaidô, reaching a length of $2\,{}^1/_2$ to 3 feet. This is omniborous, feeding chiefly on small fishes. In lake Kutcharo in Hokkaidô, this spawns from April to May, ascending rivers or streams from the lake to spawn and going down to ocean after spawning. It is called that the Ainu Race in Hokkaidô makes shoes from this skin.

Genus Salvelinus (NILSSON) RICHARDSON, 1836.

Salvelini, NILSSON, Prodr. Ichth. Scand., 7, 1832.
Salvelinus, RICHARDSON, Fauna Bor. -Amur., III, 169, 1836.
Baione, DE, KAY, N. Y. Fauna: Fishes, 244, 1842.
Umbla, RAPP, Fische Bodensee, 32, 1854.

Characters: Body moderately elongate. Mouth large or small. Teeth of jaws, palatines, and tongue essentially as in *Salmo*, the hyoid patch present or not. Vomer boat-shaped, the shaft much depressed, without raised crest, with teeth on the head of the bone and none on shaft. Scales very small, 200 to 250 in a lengthwise series. Fins moderate, the caudal forked in the young, truncate in some species in the adult. Sexual peculiarities not strongly marked, the males with the premaxillaries enlarged and a fleshy projection at the tip of the lower jaw. Coloration dark, with round, white or red spots, the lower fins sometimes with marginal bands of black, reddish, and pale.

Distribution: Northern parts of Asia, Europe and North America; mostly found in streams and lakes with lower temperature. Two types, one is land-locked form and the

other is catadromous form.

Catadromous types show a silver colour. In 1934, DYMOND et VALDYKOV distinguished two types; the one is called *Salvelinus alpinus* type distributed widely in the northern part of Asia, Europe and American continents while the other is called *Salvelinus fontinalis* type is found in somewhat limited area of the eastern part of Northern America.

Key to the Japanese species of Salvelinus

a[1]. Lateral spots all smaller than eye, mostly smaller than pupil, bright scarlet rounded blue ring; no spots on head; lower fins with the first ray milkyish white.

b. Head shorter, less than one-fourth length of body.

c[1]. Pyloric coeca 24 to 33; gill-rakers 20 to 24; branchiostegals 11–12; head 4.25 to 4.5 in length .... **S. malma**

c[2]. Pylocric coeca 23 to 25; gill-raker 18 to 20; branchiostegals 12–13; head 3.8 to 4.4 in length. .... **S. pluvius**

a[2]. Lateral spots pale yellowish, irregular in size, mostly largely than pupil, some about as large as eye, extending more or less below lateral line; lower fins pale; scales about 200.

d[1]. Head 4.5 to 4.6 in length; no spots on head; caudal well forked; coeca 20; gill rakers 18; branchiostegals 13-13, ... **S. leucomaenis**

d[2]. Head 4 in length; pale spots covering top of head; caudal shallow-forked; coeca 17; gill rakers 14; brancgiostegals 12–13 .... **S. imbricus**

Remarks: The Japanese species of the present genus *Salvelinus* are classified by the existence of red and white spots on the lateral sides, number of branchiostegals, gill rakers, pyloric coeca, as well as the length of upper jaw, the number of scales on longitudinal series and the features of scales. But we found many variations of these characters in many individuals on our hands. YASUHARU, OTA in 1918, mentioned four species of the genus *Salvelinus* in Japan.

Salvelinus malma, *S. kundsha* (= *S. leucomaenis*), *S. pluvius* and *S. latus* the last of which was described as a new species.

JORDAN and MCGREGOR also found four species: *Salvelinus malma*, *S. pluvius*, *S. leucomaenis* and *S. imprius*. The last species was described by them as a new species.

In 1938, MASAMITSU ÔSHIMA described *Salvelinus malma*, *S. leucomaenis*, *S. pluvius* and *S. miyabei* and took *S. latus* and *S. imbricus* under the synonymes of *Salvelinus leucomaenis*.

KATSUZO, KURONUMA in 1943 divided the species of *Salvelinus* distributed in Horomushiro Island, one of the Kuril Islands into two species, one is *Salvelinus malma* and the other is *Salvelinus leucomaenis*. They are clearly distinguishable by the characters of the number of branchiostegals, vertebrae, and of pyloric coeca. SHIGEO, TANAKA has mentioned that all the species of *Salvelinus* described by many authors are included under the nake of *Salvelinus malma*. But generally, the many authors distinguished two species under two groups, one has red spots on the laterals called *Salvelinus malma* type and the other has white spots instead of red ones on the laterals called *Salvelinus leucomaenis* type.

Referring to the literatures of Japanese charrs found in the Japanese waters, BREVOORT identified the specimen collected by Commander PERRY at Hakodate, Hokkaidô, with *Salvelinus leucomaenis* (PALLAS). It was a first time to describe "*Iwana*," one of

the species of Japanese charrs by him.

In 1876, HILGENDORF described a new species *Salmo pluvius* collected at Hikko and not mentioned details of localities. We had an old record that "Iwana" was introduced the species into Chuzenzi lake from River Daiya by HOSHINO S. at Hosoo, Nikko-machi, Ibaraki Prefecture.

In 1897, CH. ISHIKAWA listed *Salmo leucomaenis* PALLAS from Shiribeshi, Hokkaidô and *Salmo pluvius* HILGENDORF from Etorufu, Tokachi, Aomori, Kôzuke, Kizo, Chichibu, Kaga and Kamo Rivers.

In 1918 JORDAN & SNYDER distinguished three species and one new species *Salvelinus latus* from two specimens collected at Nô, Niigata Prefecture by KOHE, NONAKA.

In 1923, JORDAN and MCGREGOR described three species *Salvelinus pluvius* (HILGENDORF), *Salvelinus imbricus* JORDAN et MCGREGOR and *S. leucomaenis* (PALLAS). They took *S. kundscha* under the synonyme of *S. alpinus* and restore *S. leucomaenis*. They also described a new species *Salvelinus imbricus* from a specimen collected at Hamada, Iwami, Shimane Prefecture.

20. Salvelinus malma (WALBAUM).
"Oshorokoma"
(Text-fig. 49)

Salmo malma WALBAUM 1792, Artedi Piscium, p. 66.

Salmo leucomaenis PALLAS, 1811, Zoogr. Rosso-Asiat., iii, p. 250. - BREVOORT, 1856, Exped. Japan, p. 276, pl. x, fig. 3. - STEINDACHNER, 1870, Sitzber. Ak. Wiss. Wien, p. 15. - ISHIKAWA, 1897, Prel. Cat., p. 21.

Salmo curilus PALLAS, 1811, Zoogr. Rosso-Asiat., iii, p. 251.

Salmo callaris PALLAS, 1811, Zoogr. Rosso-Asiat., iii, p. 353. - GÜNTHER, 1866, Cat. Fish., VI, p. 143.

Salmo laevigatus PALLAS, 1811, Zoogr. Rosso-Asiat., iii, p. 385.

Salmo nummifer CUVIER et VALENCIENNES, 1848, Hist. Nat Poiss., xxi, p. 367.

Salmo fariopsis STEINDACHNER, 1870, Sitzber. Ak. Wiss. Wien, p. 17, pl. 1, fig. 3.

Salmo tudes COPE, 1873, Proc. Amer. Phil. Soc. Phila., p. 24.

Salmo pluvius HILGENDORF, 1876, Monastsber. Ges. Ostasien, p. 25. - ISHIKAWA, 1897, Prel. Cat., p. 21.

Salvelinus malma JORDAN et GILBERT, 1883, Synopsis, p. 319. - EVERMANN, 1891, Bull. U. S. Fish Comm. xi, p. 50. pl. xxv, fig. 1. - JORDAN et EVERMANN, 1898, Fish N. and M. Amer., I, p. 508, 1898, iii, p. 2823. - JORDAN et GILBERT, 1989, Rept. U. S. Fur Seal Comm., iii. - JORDAN et SNYDER, 1902, Proc. U. S. Nat. Mus., xxiv, p. 583. - TANAKA, 1927, Fig. Descrip. Fish. Japan, pp. 875-880, pl. clxxx, fig. 492. - OSHIMA, 1938, Bot. & Zool., vol. 6, no. 9, pp, 1494-1496, fig. 1. table. 1, no. 11, p. 1983-1985.

Salmo kundscha JORDAN et GILBERT, 1898, Report U. S. Fur Seal Comm., iii, p. 438, pl. xlv.

Salvelinus kundscha JORDAN et EVERMANN, 1898, Fish. N. and M. America, iii, p. 2823. - JORDAN et SNYDER, 1902, Proc. U. S. Nat. Mus., xxiv, p. 582.

Salvelinus pluvius JORDAN et SNYDER, 1902, Proc. U. S. Nat. Mus., xxiv, p. 582. - JORDAN et MCGREGOR, 1925, Mem. Carn. Mus., x, p. 141, pl. vii, fig. 2, pl. viii, fig. 14.

Salvelinus leucomaenis JORDAN et MCGREGOR, 1925, Mem. Carng. Mus., x, p. 142, pl. vii, fig. 3, pl. viii, fig. 15.

Salvelinus miyabei OSHIMA, 1938. - Bot. & Zool., vol. 6, no. 10, pp. 1671- 1674, fig. 4., vol. 6, no. 12, p. 1986. - OKADA et IKEDA, 1938, Scien. Rep. Tôkyô Bunrika Daigaku. Sect. B. No. 55. pp. 143-144. fig. 1.

The original description* is as follows:

Salmo malma, Ruffis Golet. Pennant. arst. zool. introd. 126, D. 12, P. 14, V. 8, A. 10.

Corpus bipedale, perangstum, cylindraceum. Caput illi Farionis simile. Squamae minutae. Dorsum & latera caerulscentia, maculis coccineis con lpersa. Abdomen album. Pinnae ventrales & analis rubrae. Cauda parum bifurca. Adscendit fluvios Kamschatkae.



Text-fig. 49. ***Salvelinus malma*** (WALBAUM).

Description: Head $3^2/_3$; depth 4; eye $4^1/_2$; D. 11; A. 9; scales 39–240–36; pyloric coeca large, 45 to 50; gill rakers about 8 12. Body stout, the back somewhat elevated, deeper, and less compresed than in *S. fontinalis.* Head large, snout broad, flattened above. Mouth large, the maxillary reaching past the eye. Fins short; the caudal fin slightly forked or almost truncate; adipose fin usually large; in large specimens its length is twice that of the eye. General color olivaceous; the sides with round red spots nearly the size of the eye, the back commonly with smaller pale ones, features of coloration which distinguishes this species at once from the others; lower fins colored as in *S. fontinalis*, dusky, with a pale stripe in front, followed by a dark one; sea-run specimens silvery, with the spots faint or obsolete; fins and back without dark reticulations. Gill covers without concentric striae. Length 13 cm. to 50 cm. Streams east and west of the Cascade Range from the upper Sacramento to Montana, Alaska, and Kamtchatka, generally abundant northward, descending to the sea, where it reaches a weight of about 12 ponds. One of the most beautiful and active of all the *Salmonidae.* In small mountain brooks, dwarf forms occur but it is not necessary to distinguish these by separate names.

(*Malma*, a vernacular name in Kamtchatka).

Distribution: This is distributed in the districts facing on Berling and Okhotsk Seas, from Kamtchatka to Kurile and Saghalien, in Japan. It is distributed in many rivers of Hokkaidô. Kamchatka (WALBAUM): Kamchatka (PALLAS); Hakodate (BREVOORT); Descastris Bay (STEINDACHNER); Shiribeshi, Hokkaidô (ISHIKAWA); Kurile Islands (PALLAS); Berling Sea (PALLAS); Nikkô (HILGENDORF); Iturup; Tokachi; Aomori; Tochigi; Kiso; Chichibu; Kaga; Kamo River (ISHIKAWA); Nemuro, Hokkaidô; Iturup Islands; Shiribeshi, Hokkaidô (JORDAN & SNYDER); Lake Chûzenji; Nemuro; River Ohata at

* Petri Artedi Bibliotheca Ichthyologica., Iohanne Iulio WALBAUM, 1788, p. 66.

Table 23. Measurements of *Salvelinus malma* (WALBAUM).

Collection	O. H. B. S.†		O. H. B. S.†		
	mm.		mm.	mm.	mm.
Total length	282.0*	234.0*	214.0**	190.0**	152.0**
Body length	240.0	196.0	186.0	164.0	130.0
Body length/Head	3.87	3.92	4.22	4.26	4.18
Body length/Depth	4.62	4.84	4.42	4.80	4.72
Body length/Predorsal length	2.18	2.11	2.32	2.24	2.32
Body length/Prepectoral length	4.21	4.00	4.32	4.62	4.90
Body length/Preventral length	1.87	1.85	1.96	1.93	1.96
Body length/Preanal length	1.30	1.31	1.36	1.35	1.38
Head/Snout	4.13	3.94	3.52	3.85	4.07
Head/Upper jaw	2.00	1.96	1.84	1.95	2.30
Head/Interorbital width	3.10	3.03	3.14	2.75	3.10
Head/Diameter of Eye	5.63	5.00	5.50	4.94	4.48
Head/Length of Caudal peduncle	1.67	1.76	1.47	1.42	1.50
Head/Depth of Caudal peduncle	2.76	2.56	2.32	2.32	2.44
Head/Length of Dorsal fin	2.19	2.00	1.66	1.62	1.90
Head/Length of Anal fin	2.94	2.86	2.32	2.32	2.88
Head/Height of Dorsal fin	1.90	1.82	1.66	1.57	1.69
Head/Height of Anal fin	1.97	1.85	1.92	1.79	1.69
Head/Pectoral length	1.70	1.70	1.52	1.57	1.60
Head/Ventral length	1.82	2.00	1.54	1.68	1.60
Date	5, VIII, 1937				
Locality	Kurile Islands;		River Ishikari, Hokkaidô		

* These specimens are identified with **Salvelinus miyabei** OSHIMA.
** These specimens are identified with **Salvelinus malma** (WALBAUM).
† Ôtsu Hydrobiological Station attached to Kyôto University.

Aomori; Kawajiri, Prov. Rikuchu; Kurile Islands (JORDAN & SNYDER); Echigo (JORDAN & MCGREGOR); Hamada, Prov. Iwami (JORDAN & MCGREGOR); Lake Shikaribetsu, Sounkei, Ishikari, Hokkaidô (OSHIMA, OKADA, IKEDA).

Northern Pacific, ranging to Arctic seas; in southern part of Japan it is restricted in the coldest headwaters of the river, landlocked owing to much warmer temperatures of lower courses of the streams. Southern limit in Japan of the species is River Subu, Iwami Prov. on the Japan sea side and Provinces Yamato and Kii on the Pacific side; perhaps also in the headwaters of River Yoshino, Shikoku; so far as known the species never occurs in Kyûshû.

Remarks: Accoring to EVERMANN and GOLDSBOROUGH*, the present species is very common in Alaska and swarms in every stream and lake about in the islands from the Columbia to Bering Sea. This is must persistent and destructive enemy of the salmon eggs and fry. Not only during the spawning time do the trout remain, but so long as the eggs are to be found; and after the eggs have hatched the fry and fingerlings fall a ready prey to this voracious trout, which pursues them not only in the streams and lakes but down to salt water, where the destruction continues until the salmon have grown too large to be eaten. The average of the 14 males was; length 73 cm. weigth 6.93 pounds; females, length 65 cm. weight 6.2 pounds. The trout could be seen jumping

* 1907. The Fishes of Alaska, pp. 264-266, pl. x.

quite as often as the salmon and apparently with even greater success in ascending the falls. They have an advantage in their smaller size, being able to find resting places in the small rocks. They are able, however, to jump very well, and to maintain themselves against or even to ascend a practically vertical current. ISHIDA, J,* (1942) described four forms of *Salvelinus* in southern Saghalien; *Salvelinus malma leucomaenis*, (sea-run form and dwarf form) and *S. malma malma* (sea-run form and dwarf form).

1. Sea-run form *Salvelinus malma leucomaenis* (PALLAS) is called "Amemasu" in Japanese, is found in lakes and streams of Hokkaidô and Kurile Islands. The color on young of 2 years old in fresh, is provided with a dark band on the dorsal fin and a dark margin on the caudal end. They live in the streams until May or June in Saghalien but never found there after. The charrs which have descended to the sea are captured on the shore of Rakuma from July to October. The dark band on the dorsal fin and the dark margin of the caudal end still remain. In adults ascending to the river for spawning in September and October the dark dorsal band and the dark caudal margin disappear almost completely.

2. Dwarf-form *Salvelinus malma leucomaenis* (PALLAS) called "Ezoiwana" in Japanese always lives in freshwater and never descends to the sea. The charrs are lacking the dark band on the dorsal fin.

Table 24. Measurements of *Salvelinus malma* (WALBAUM)††

T.L.	H.L.	B.H.	S.L.	E.D.	I.S.	U.	H.P.	D.F.	P.F.	A.F.	B.S.	B.R.	Sc.	S.	Y.
225	4.05	4.85	3.56	6.25	2.95	1.79	2.27	3.10	1.13	1.8	5+12	12	38-205-35	♂	2
150	4.00	4.00	3.30	4.70	3.30	2.06	2.35	3.12	1.12	1.8	5+12	11	38-208-36	♂	1
238	4.15	4.15	3.57	5.00	3.12	1.93	2.17	3.10	1.13	1.8	5+12	12	38-210-35	♀	2
184	4.00	3.80	3.84	5.00	3.33	2.10	2.22	3.10	1.13	1.8	5+11	13	38-205-36	♀	2
152	4.05	3.92	3.55	5.34	2.90	2.14	2.13	3.10	1.13	1.8	5+13	12	38-205-36	♀	1
155	4.32	4.32	3.34	5.00	3.00	2.14	2.14	3.10	1.13	1.8	5+12	11	38-209-35	♀	1
125	4.39	4.76	3.13	5.00	2.79	2.17	2.27	3.10	1.13	1.8	5+11	11	38-205-35	♀	1

† Measured by M. OSHIMA from the specimens collected at River Taradomari, Maoka, Karafuto.

Table 25. Measurements of *Salvelinus malma* (WALBAUM)††

T.L.	H.L.	B.H.	S.L.	E.D.	I.S.	U.	H.P.	D.F.	P.F.	V.F.	A.F.	B.S.	B.R.	Sc.	S.
142	3.93	4.52	3.89	4.42	2.82	2.06	2.21	3.9	1.12	1.8	3.8	8+11	12	40-210-40	♂
176	4.10	4.35	3.58	4.63	3.08	2.05	2.18	3.10	1.12	1.8	3.8	8+14	12	41-210-40	♂
137	4.27	4.44	3.42	4.50	3.00	2.07	2.08	3.10	1.12	1.8	3.8	4+15	10	41-205-40	♂
229	3.64	3.50	3.93	4.80	3.42	2.00	2.28	3.9	1.13	1.8	3.9	8+15	12	40-210-40	♂

†† measured by M. OSHIMA from the specimens collected at River Rubetsu, Kurile Islands.

Abbreviations in the table

T.L.-Total length, H.L.-Head length, B.I.-Body height, S.L.-Snout length E.D.-Eye diameter, I.S.-Interorbital space, U.-Upper jaw, H.P.-Height of Caudal peduncle, D.F.-Dorsal fin, P.F.-Pectoral fin, V.F.-Ventral fin, A.F.-Anal fin, B.S.-Number of Branchiostegals, B.R.-Number of Branchial ray, Sc.-Scale number, S.-Sex, Y.-Age.

* ISHIDA, JURO, 1942, Zool. Mag., vol. 54, pp. 347, 352, pls. I-II.
† OSHIMA, M. 1938, Bot. and Zool., vol. 6, no. 9, pp. 1496.
†† OSHIMA, M. 1938, Bot. and Zool., vol. 6, no. 10, p. 1670.

3. Sea-run form *Salvelinus malma malma* (WALBAUM) is called "Oshorokoma" in Japanese. The smaller ones have a somewhat dark band on the dorsal fin and a dark margin on the caudal end. This form descends to the sea.

4. Dwarf-form *Salvelinus malma malma* is called "Karafuto Iwana" in Japanese and is restricted in brooks and streams throughout the year. Small ones are brighter in color. The breeding season continues from November to December.

The present species has two forms; one is sea-run form and the other is landlocked form. The landlocked form, 250 mm. in size, spends all his life in the upper water of a river and the female spawns in October and November. The sea-run form descends into the sea and grows up to adult. They ascend into rivers again for spawning. In the River Horonai they ascend around July and spawn in the end of October. The food is consisting mostly of Aquatic insects- *Trichoptera*, *Diptera*, *Ephemera* and *Hymenoptera* -spiders, water mites, *Myriapods* and Crayfish and partly of young fishes as charr. Sometimes they take eggs and youngs of *Salmonid.*

21. Salvelinus pluvius (HILGENDORF).

Rockling, "Iwana"

(PL. XV, figs. 1–4)

Salmo pluvius HILGENDORF, 1876, Monatsber, Ges. Ostasien, p. 25. - ISHIKAWA 1897, Prel. Cat., p. 21.
Salvelinus pluvius JORDAN et SNYDER, 1902, Proc. U. S. Nat. Mus., vol. 24, no. 1265, pp 582-583. - JORDAN et MCGREGOR, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 141 - 142, pl. 7, fig. 2; pl. 8, fig. 14. - OKADA et IKEDA, 1938, Saitô Hôon Kai Mus. R. Bullet, no. 15, p. 88, textfig. 1. - OSHIMA, 1938, Bot. & Zool., vol. 6, no. 11, pp. 1824-1826, figs. 6-8, p. 1986. - NIWA, 1954, Kisodani no Sakana, pp. 60-63.

Description: Head 4 in length; depth $4\,^1/_4$; depth of caudal peduncle $2\,^1/_2$ in head; eye $5\,^1/_5$; snout $3\,^3/_4$; interorbital space $3\,^1/_4$; maxillary $1\,^3/_4$; D. 10; A. 9; scales in lateral series 200, in transverse series 41 + 41; pores in lateral line 124.

Body rather elongate and moderately compressed; head slightly under 4 in length to end of vertebrae, rather short, blunt; the orbital space broad and convex; depth 5; depth of caudal peduncle 2.84 in head; eye 6.5; mouth large, the maxillary extending past eye a distance equal to diameter of pupil. Teeth on jaws weak, a single row on the palatines, a small cluster on anterior part of vomer, none on the shaft; teeth on the tongue in 2 rows, somewhat stronger than those of the jaws, curved backward. Pseudobranchiae small; gill rakers on first arch 6 + 9; rather long and slender; branchiostegals 13-13; pyloric coeca 21. Dorsal and anal of equal height, the longest rays contained $1\,^7/_8$ times in head; pectorals $1\,^2/_3$ in head; ventrals $1\,^8/_9$. Supplemental appendage of ventral slender, its length $2\,^2/_5$ in the fin. Scales in lateral series 185, in transverse series above lateral line 38. They show that the outline rectangular elliptic, with the anterior-posterior axis the longest; focus nearly central, sub-circular; most of circuli continued around on the exposed area, which appears much like the concealed area; circuli widely

spaced, inclined to interbranch, especially on the anterior radius; blank area restricted to two posterior marginal circuli; submarginal blank zone limited to axial portion of circuli nine, ten, eleven, and twelve posteriorly; radial spurs common.

Color in alcohol, smoky-brown above; lateral line pale below, back blackish grey, with numerous light spots about as large as pupil, ventral and anal fins edged anteriorly with bright yellow; upper surfaces of pectorals and ventrals dusky; caudal fin slaty, unspotted, margined above and especially below with whitish.

Color in fresh, bluish grey on the back; lighter and slightly yellowish on the belly. Head dark grey without spots. Light greyish circular, smaller than pupil, spots on the lateral. Below the lateral line, red spots intermingled together; elliptical parr-marks on the lateral line. Dorsal and adipose fins grey, somewhat lighter along the outer margin. Pectoral, ventral and anal fins yellowish grey; caudal yellowish grey, reddish along the outer margins of upper and lower lobes.

Distribution: The present species are distributed in the upper waters of many rivers along the Pacific coast, covering from the River Tone, Ibaraki Prefecture to the River Iwakuni, Yamaguchi Prefecture, the River Kumano (Aoyagi); the Kinokawa, Wakayama Prefecture (Tanaka), rivers flow into Lake Biwa (Miyadi); the Miyagawa, Mie Prefecture (Okada); River Shiman, Gunma Prefecture; River Kinu Tochigi Prefecture; River Ara, Saitama Prefecture; River Yashu, River Kusano, Biwa Lake, Shiga Prefecture (Aoyagi); Aomori Prefecture, Akita Prefecture, Yamagata Prefecture; Iwate Prefecture; Miyagi Prefecture; Fukushima Prefecture (Okada & Ikeda)

Table 26. Measurements of *Salvelinus pluvius* (Hilgendorf).

Collection	O. H. B. S.*			
Total length	156.0 mm.	180.0 mm.	166.0 mm.	204.0 mm.
Body length	134.0	155.0	146.0	180.0
Body length/Head	3.88	3.52	4.23	3.95
Body length/Depth	4.05	4.60	4.72	4.72
Body length/Predorsal length	2.24	2.11	2.18	2.25
Body length/Prepectoral length	4.33	4.10	4.56	4.50
Body length/Preventral length	1.89	1.83	1.87	1.86
Body length/Preanal length	1.37	1.33	1.26	1.34
Head/Snout	4.32	3.82	4.15	3.93
Head/Upper jaw	2.06	1.64	1.79	1.84
Head/Interorbital width	3.00	3.27	3.41	3.47
Head/Diameter of Eye	4.78	4.95	4.65	4.75
Head/Length of Caudal peduncle	1.56	1.79	1.41	1.48
Head/Depth of Caudal peduncle	2.65	2.75	2.30	2.44
Head/Length of Dorsal fin	2.09	2.15	1.64	1.62
Head/Length of Anal fin	2.65	2.73	2.03	2.54
Head/Height of Dorsal fin	1.60	1.74	1.68	1.76
Head/Height of Anal fin	1.72	1.85	1.77	1.77
Head/Pectoral length	1.50	1.61	1.72	1.92
Head/Ventral length	1.88	1.98	1.72	1.92
Date	27,X,1927	1,VI,1930	14,VI, 1933	
Locality	Lake Kizaki, Nagano Prefecture	River Kiso, Gifu Prefecture	Shinshû, Nagano Prefecture	

* Ôtsu Hydrobiological Station, attached to Kyôto University.

Remarks: The present species called "Iwana" in Japanese is widely found in the upper regions of all the mountain rivers and brooks from all Japan. In 1954, NIWA mentioned that the present species is one of the glacial relict in Japan. During the Pliocene and Diluvial epochs, we had a glacial age in Japan and in that time, the climate and the water temperature were very much cooler than in the present time. The northern forms the *Salvelinus* group, were spreading over the southern sea. Then in the past glacial age, nearly the end of Diluvial epochs, the climate became warmer and the water temperature gradually raised. The northern cold water form as *Salvelinus pluvius* is now keeping its life in the upper region of mountain stream and river being landlocked after the post-glacial age as one of the relic animals.

According to M. OSHIMA, the *Salvelinus pluvius* occurred in the upper region of mountain stream, nearly uppper than 1,500 meter heigh and the water temperature 15°C. in summer. S. NISHIO[1] mentioned the food of *Salvelinus pluvius* in Hokkaidô in 1934. He found 7,994 insects in the stomachs of 289 specimens collected at the upper region of River Sôunkei, Ishikari Province, Hokkaidô during June to September of 1932–1933. They belong to 25 species of 12 orders including 40% are Trichopteran larva, 24% Dipteran larva, 19% Ephemeran larva and Coleopteran and Hymenopteran larva. Outside of insects, he found arachnids, water mites, myriapods and small fishes.

MATSUNAE, TSUDA[2] mentioned the food of *Salvelinus pluvius* from the specimens collected at Kisodani, Nagano Prefecture. He examined six individuals and found following foods in their stomach.

The food contents of 6. *Salvelinus pluvius* collected at the upper regions of River Otaki, on August, 1941.

Ephemeran adults	3	Arachnida	3
Plecopteran adults	3	Ephemeran larva	102
Trichopteran adults	8	Plecopteran larva	12
Dipteran adults	4	Trichopteran larva	47
Dragon fly adults	1	Dipteran larva	8
Bees	6	Driopidae	2
Staphylinus	2		201 individuals
Carabus	1		

NIWA, H. mentioned the spawning season in Kisodani, Nagano Prefecture begins from the end of September and ends on the beginning of October.

This season may somewhat later, about a week or 10 days than that of *Salvelinus macrostomus* ("Amago") = *Salvelinus leucomaenis*?

The distinguished characters between *Salvelinus pluvius* and *S. leucomenaeus* are the existence of red spots and well-marked parr marks in the former species.

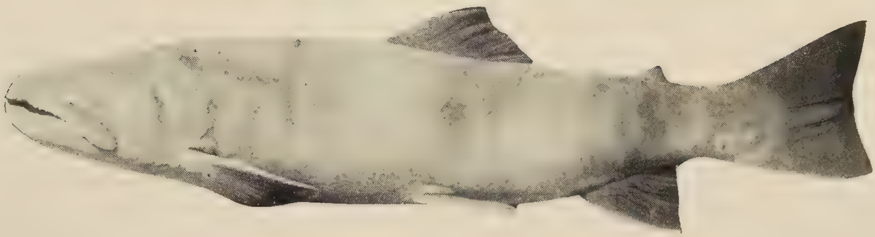
The present species is quite endemic species lived in the colder waters of the upper region of mountain rivers and streams.

1) NISHIO, SHINROKU, 1934; Rikusuigaku Zasshi, vol. 3, pp. 62–70.
2) MATSUNAE, TSUDA, 1942; Yamano Seibutsu, Osaka, pp. 90-92.

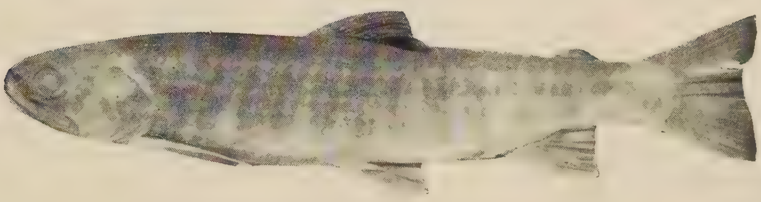
PLATE XV



1



2



3



4

1. Young of ***Salvelinus pluvius*** (HILGENDORF) clasping shell in mouth.
2. ***Salvelinus pluvius*** (HILGENDORF), in breeding season. ♂
3. ***Salvelinus pluvius*** (HILGENDORF), in breeding season. ♀
4. ***Salvelinus pluvius*** (HILGENDORF). ♀

In the upper region of the River Tama, the breeding season occurrs during the middle of October and the beginning of November. The females of three years deposit eggs in the sands and pebbles of the current water. The youngs live in the cool water, under the water temperature below 15°C. The food is mostly aquatic insects- *Trichoptera*, *Ephemera* and *Diptera*, sometimes the young takes the eggs of *Oncorhynchus masou*.

22. Salvelinus leucomaenis (PALLAS).

"Amemasu, Ezoiwana"

(Text-fig. 50)

Salmo leucomaenis PALLAS, 1811, Zoogr. Rosso. Asiat., III, p. 356.

Salvelinus leucomaenis OSHIMA, 1938, Bot. & Zool., 6 (9), pp. 1496–1497, fig. 2, table 1, - Bot. & Zool., 6 (10), pp. 1670–1671, fig. 3. table 1, Bot. & Zool., 6 (11), pp. 1821–1824, fig. 5, table 1.

Oncorhynchus macrostomus UI, 1932, Kishû Gyofu, pp. 63–64.



Text-fig. 50. ***Salvelinus leucomaenis*** (PALLAS).

Description: Body elongated and compressed laterally. Head moderately large; snout pointed at end; interorbital space flattened and broad. The end of upper jaw beyonds posteriorly to the posterior edge of the eye. Jointed portion of the lower jaw rectangular, somewhat projected to upper side. The origin of dorsal fin inserted somewhat nearer the end of snout; the end of pectorals reach somewhat posteriorly to the mdle between anus and the pectorals.

Ventral fin small, its end reaches somewhat posteriorly to the middle between the anus and the ventral fin. Caudal fin shallowly forked.

Color in fresh, the back is dark gery and belly is lighter. Small circular cream spots scattered on the lateral, those below the lateral line somewhat larger, nearly as large as pupil, and orange in color. Dorsal and adipose fins greyish black; caudal yellowish grey, reddish along the upper and lower margins. Pectoral and ventral fins light greyish, somewhat yellowish and milky white along the outer margin. Anal fin yellowish grey and margwhite along the anterior margin.

Table 27. Measurements of *Salvelinus leucomaenis* (PALLAS).*

Loc.	T.L.	H.L.	B.H.	S.L.	E.D.	I.S.	U.	H.P.	D.F.	P.F.	V.F.	A.F.	B.S.	B.R.	S.N.	S.
Nishibetsu River	269	3.80	3.86	3.52	5.45	3.00	1.72	2.40	3.10	1.13	1.8	3.9	5+11	14	36-212-40	♀
———	225	4.01	3.91	3.70	5.35	3.20	2.00	2.40	3.10	1.13	1.8	3.9	5+11	14	35-215-38	♂
Kushiro R.	185	8.95	3.75	4.00	5.00	3.20	2.00	2.35	3.10	1.13	1.8	3.9	5+9	13	35-192-40	♂
———	177	4.10	4.30	3.70	5.30	3.30	1.85	2.55	3.10	1.13	1.8	3.9	5+11	12	34-215-40	♂

*The measurement is made by M. OSHIMA from the specimens collected in Hokkaidô.

Table 28. Measurements of *Salvelinus leucomaenis* (PALLAS), collected in Honshû.**

B.L.	H.L.	B.H.	S.L.	I.S.	E.D.	U.	H.P.	D.F.	P.F.	V.F.	A.F.	B.S.	B.R.	S.N	S.	Loc.
224	3.85	4.62	3.40	3.18	5.10	1.82	2.42	3.11	1.12	1.8	3.9	6+9	13	35-225-38	♂	Tansho R.
264	4.10	5.15	3.76	3.26	5.16	1.88	2.34	3.11	1.12	1.8	3.9	5+9	13	35-225-37	♂	〃
183	3.85	5.05	3.24	3.00	4.46	1.83	2.62	3.10	1.11	1.8	3.8	5+8	13	35-220-37	♂	〃
208	3.71	4.78	3.61	3.14	4.70	1.88	2.48	3.11	1.12	1.8	3.9	6+9	12	35-210-35	♀	〃
325	3.70	4.23	3.29	2.93	5.65	1.58	2.34	3.10	1.13	1.8	3.8	5+10	12	35-225-38	♂	Oze-numa
217	4.04	4.52	3.76	2.94	4.26	1.82	2.47	3.10	1.13	1.8	3.8	5+10	11	35-212-35	♂	〃
214	3.70	4.64	3.34	2.95	5.00	1.72	2.64	3.10	1.13	1.8	3.9	5+10	13	35-215-38	♂	〃
182	4.10	4.32	3.55	3.00	4.34	1.77	2.45	3.10	1.13	1.8	3.8	5+10	11	35-225-37	♂	〃
180	3.70	4.60	3.50	3.00	4.20	1.90	2.62	3.10	1.13	1.8	3.8	4+8	11	35-230-35	♂	〃
170	3.80	4.35	3.25	3.00	4.34	1.86	2.44	3.10	1.13	1.8	3.8	4+9	11	35-210-37	♂	〃
228	3.92	4.25	3.65	3.00	4.65	1.76	2.55	3.10	1.12	1.8	3.8	5+10	12	35-220-37	♂	〃
218	4.07	5.00	3.20	2.66	4.80	1.88	2.52	3.11	1.13	1.8	3.9	5+8	12	35-220-38	♀	〃
220	3.92	4.26	3.70	3.00	4.80	1.89	2.40	3.10	1.13	1.8	3.8	4+8	11	35-212-36	♀	〃
197	3.85	4.55	3.75	3.10	4.72	1.88	2.50	3.10	1.13	1.8	3.9	5+8	12	35-218-35	♀	〃
182	3.80	4.57	3.66	2.94	4.90	1.84	2.59	3.11	1.13	1.8	3.8	5+8	13	35-224-35	♀	〃
187	3.84	4.35	3.30	3.30	4.30	1.96	2.53	3.10	1.13	1.8	3.8	4+8	13	35-222-38	♀	〃

**The measurements were made by M. OSHIMA from the specimens collected at River Tanshô and Oze-numa in Honshû.

Distribution: River Tanshô, Hida Prov. (the upper region of River Jintsû); Oze-numa, Gumma Pref.; Arakawa, Yamagata Pref.; Abukuma River and River Kitakami; Nobechi, Aomori Pref.; Shokoku, Yamagata Pref. (OSHIMA). River Abashiri; Lake Panke; River Ishikari; Lake Akan (OKADA & IKEDA). River Tanjô, Gifu Prefecture; Oze Numma, Gumma Prefecture; River Ara, Yamagata Prefecture; River Abukuma, Miyagi Prefecture; River Kitakami, Iwate Prefecture; Nobechi, Aomori Prefecture (OKADA).

23. Salvelinus imbrius JORDAN et MCGREGOR.

"Gogi"

(Text-fig. 51)

Salvelinus imbrius JORDAN et MCGREGOR, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 142-144, pl. vii, fig. 3; pl vii, fig. 15- OSHIMA, 1938, Bot· & Zool., vol. 6, no. 12, pp. 1980-1981.

The original description is as follows:

This species is based on an immature female, 9.25 inches long (W. NO.) Car. Mus. Cat. Fishes, NO. 7797, obtained from a stream near Hamada in Iwami in the Southwestern part of Japan. It is very

closely to *Salvelinus leucomaenis*, which subarctic species it may represent southward.

Body moderately elongate, not much compressed, dorsal contour slightly elevated back of occipital region; caudal fin shallowly forked; head about 4 in length; depth 4.5; depth of caudal peduncle 2.6 in head; eye 5.4; interorbital space 3.125; snout 4.33; maxillary 1.875; extending beyond eye a distance about equal to diameter of pupil; dorsal rays 12; anal-rays 9; scales in lateral series (immediately above lateral line) 185. Vomer flush with roof of mouth, four teeth in a cluster on anterior portion; roof of mouth longitudinally striated with pale and blackish shades; distance from tip of snout one-third interorbital space; about twelve palatine teeth on each side; tongue short, blunt, of a rusty color, with two rows of about five teeth on each side; teeth essentially as in *Salvelinus pluvius* and other species of *Salvelinus*. Branchiostegales 12–13; gill-rakers 5+9=14; pyloric coeca 17; vertebrae 59 (53+6+urostyle) only the last two slightly up-turned; dorsal equaling anal, 1.66 in head; pectorals 1.5 in head; ventrals fully two in head; ventrals fully two in head; ventral appendage about four in the fin; caudal shallowly forked, the lobes obtusely angled; its length 2.25 in head; peritoneum smorky, with pale stripes along ribs and a few scattered nipples. Scale under the microscope shows the outline usually wide rectangular-elliptic, with the antero-posterior axis longest; focus central, circular; circuli nearly all continous entirely around, widely spaced, nowhere angled; blank area restricted to one or two peripheral circuli posteriorly, and occasionally also to axial portion of circuli four, five, and six; nucleus of about nine circuli, which are spaced increasingly wider toward focus; radial spurs present or absent (when present scarce). Our specimen is in its fourth year. Color in spirits pale platy-brown above, paler below, but back hardly darker than sides; numerous round pale spots equally distributed over back, sides, and top of head, the largest larger than pupil and some almost as large as eye; top of head with about sixteen spots smaller than those on sides; spots extending to below lateral line. Dorsal fin rather pale, a horizontal slaty bar across middle of rays, a blackish border on first ray; caudal somewhat dusky; basal half of ventrals whitish; anal, ventrals, and pectorals pale, the first rays of each paler, pectorals very slightly dusky above; lateral line conspicously whitish.



Text-fig. 51. ***Salvelinus imbrius*** JORDAN et MCGREGOR.

Distribution: The present species is distributed in Kamtchatka, Kurile Island, Saghalien, Hokkaidô and northern Honshû. The southern limit is at the River Hikimi, a branch of the River Kôzu, Shimane Prefecture on the Japan Sea coast and the River Tone on the Pacific coast.

Remarks: In Kamtchatka and Kurile Islands, the sea-run form is found and in Hokkaidô and Saghalien the sea-run form and land-locked form, while in Japan Proper mostly landlocked form. It lives in the very cool water of upper rivers, always under the water temperature of 15°C. The sea-run form of Hokkaidô when the water tem-

perature of 9°–10° in the middle and end of August, begins to ascend a river, stays in the middle of the river for a short time and gradually ascend again up to the upper river to make the deposition of eggs on the spawning ground. The highest season for spawning is the middle of November. They like to ascend rivers on rainy nights. They mature within 4–5 years and after breeding, they go to die from exhaustion. The hatched larvae stay in rivers until April to May of two years after and when they grow up 170 mm. in body length, they gradually descend rivers into the sea. The youngs of sea-run form have a distinct black pattern on the distal part of dorsal fin, along the end of caudal fin margined with black. These black patterns gradually disappear as age advances. The descending of youngs mostly occurs on the nights when the water temperature goes down below 5°–8°C. They are always living around the shallow sea and gradually growing up into the adult. Land-locked form sometimes descends into the mouth of a river but not into the sea. It has no black pattern on the distal part of dorsal fin.

Family Plecoglossidae

Characters: Maxillary and dentary with a few, peculiar, mobile, broad flat, serrated teeth in one series, situated in skin and not attached to jaws. Premaxillaries with normal conical teeth. No supramaxillary. No orbito-sphenoid. Entopterygoid toothed. Each dentary broadened at the symphysis. Infraorbitals narrow, not reaching by far the preopercular. Mucous membrane of mouth forming a large paired fold at the symphysis of lower jaw. Number of pyloric coecum enomrous, about 400.

The only one genus *Plecoglossus* exists in the present family.

Genus Plecoglossus Temminck et Schlegel, 1846.

Plecoglossus, Temminck et Schlegel, 1846, Fauna Japonica Poiss., p. 229.
Type: **Plecoglossus altivelis.** – Tanaka, 1921, Nihongyogaku, p. 287.

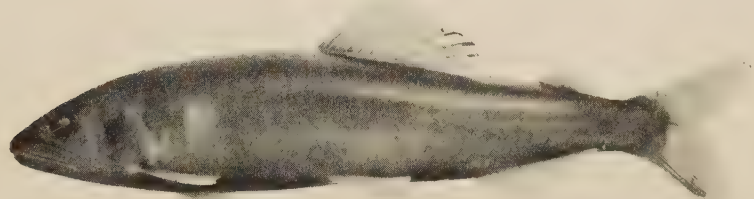
Characters: Body moderately elongate, covered with very small scales. Mouth wide, the premaxillaries with a few, small, conical, pointed teeth. Maxillaries and lower jaw with teeth of a peculiar form, lamelliform, broad, truncate, serrate, movable, seated in folds of skin; mandibles each ending in a small knob, not joined at the symphysis. Mucous membrane of interior of mouth between terminal halves of the mandible forming a peculiar organ, being raised in folds with two pouches in front and one behind. Tongue very small, with minute teeth, its top toothless; no teeth on vomer, palatines with teeth. Pyloric coeca very numerous. Eggs small. Only one species *Plecoglossus altivelis* is known in the present genus.

24. **Plecoglossus altivelis** TEMMINCK et SCHLEGEL.

"AYU"

(PL. XVI, figs. 1–17; Text-fig. 52)

Plecoglossus altivelis TEMMINCK et SCHLEGEL, 1846, Fauna Japonica, Poiss., p. 229, pl. cv, fig. 1. – GÜNTHER, 1866, Cat. Fish., vi, p. 165. – ISHIKAWA, 1895, Zool. Mag., Tokyô, vii, p. 129. – ISHIKAWA, 1897, Prel. Cat., p. 19. – JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., p. 349. – JORDAN SNYDER, 1902, Proc. U. S. Nat. Mus., vol. 24, pp. 584-585, fig. 4. – OTAKI, 1907, Nihongyorui Zusetsu, pp. 37-39. – MATSUBARA, 1908, Nihon Gyorui Zusetsu, pp. 91-94. – TANAKA, 1921, Nihon Gyogaku, pp. 287-288, fig. 89. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 147-149, pl. 8, figs. 10-12. – OKADA et IKEDA, 1938, Saito Hô-on Kai Mus., R. Bull. 15, pp. 88-89. – ABE, 1933, Ayu, Tokyô, pp. 1-265, figs. 1-82. – UI, 1932, Kishu Gyofû, Osaka, pp. 62-63. – OKADA et NAKAMURA, 1948, Nihon no Tansuigyorui, pp. 141-142, fig. 59. – NIWA, 1954, Fish of Kiso Valley, pt. 1, pp. 78-82, table 29, fig. 9. – AOYAGI 1957, Gen. Note Fresh Fish. Jap. Arch., pp. 50-53, fig. 40-42, table 1.



Text-fig. 52. ***Plecoglossus altivelis*** TEMMINCK et SCHLEGEL.

The original description is as follows:

Les Saumons (Salmo).

Salmo (Plecoglossus) altivelis, Pl. CV, fig. 1. Il parait que ce poisson curieux a été jusqu' à présent inconnu aux naturalistes; je n' en ai du mions trouvé nulle part aucune indication, et il n' en est pas non plus fait mention dans les descriptions que PALLAS a données dans sa Zoographie de l' empire russe des nombreux Salmonoides du grnad Océan Septentrional. Ce poisson, s' éloignant par son système de dentition de tous les Salmonoides connus et offrant une structure tout à fait particulierè de la langue, nous avons cru devoir créer, en faveur de cette espèce, un sous-genre à part, que nous proposons de désigner sous le nom de *Plecoglossus.*

Il nous est parvenu une dixaine d' individus de ce Salmonoide du Japon, en partie empaillés, en partie conservés dans la liqueur forte. Les plus grands de ces individus portent environ huit pouces en longueur totale. Les formes de cette espèce en général rappellent celles de nos Saumons proprement dits d' Europe, et elles ne présentent rien de particulier, sinon que la dorsale est assez élevée comme dans les *Thymalles,* et que les mâchoires sont recourbées par devant comme cela a lieu dans le bécard et dans plusieurs Salmonoides, de l' Asie. La hauteur du tronc égale la longueur de la tête, qui est environ cinq fois et demie dans la longeur totale du poisson. Le diametre transversal du tronc ne fait que la moitié de son diamètre vertical. La tête est conique, un peu bombée au dessus des yeux, et à sommet légèrement arrondi vers les côtés. Les yeux sont de grandeur moyenne et latéraux; leur intervalle égale le double de leur diametre, qui est un peu plus considérable que la moitié de la longueur du museau. Les narines s'ouvrent sur la ligne supérieure des yeux; elles sont séparées par une

* TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poisson, p. 229.

cloison mince, et beaucoup plus rapprochées des yeux que de l'extrémité du museau. Cette partie est assez charnue a son extremite, qui est formée par l'intermaxillaire et recourbée vers le bas. La bouche, fendue jusqu' au de là des yeux, est fermée sur ses bords latéraux par les maxillaires. La mâchoire inferieure forme par devant, de chaque côté, une saillie dans la forme d'un tubercule conique, l'espece laissé entre ces deux saillies étant destiné à recvoir la pointe recourbée du museau. Les sous-orbitraires offrent une forme allongée, et longent le bord supérieur du maxillaire. Les opercules ne présentent rien de particulier; ils offrent, ainsi que les autres parties de la tête, une surface lisse et unie. Les écailles sont petites et trés-serrées, de forme ovale, à bords lisses, à surface couverte de stries concentriques et de points noirs seulement visibles pour l'aeil armé. La ligne latérale, un peu plus rapproche de celle du ventre que de celle du dos, forme par devant, une légère courbure vers le bas. L'anus s'ouvre sur la fin du troisieme cinquième de la longueur du corps.

Les nageoires offrent la disposition survante. La première dorsale commence sur la fin du deuxième cinquième de la longueur du poisson; son bord supérieur est légèrement échancré et ses derniers rayons sont un peu plus longs que les autres; ils ègalent la hauteur du corps à cet endroit; ses deux premiers rayons sont indivisés et le premier est de moitié plus court que le deuxième. Les ventrales naissent sous l'aplomb du cinquième rayon de cette première dorsale; elles diminuent un peu en longueur vers le derrière, et elles s'étendent avec leur pointe jusqu'un peu au de là de la distance comprise entre leur aiselle et la base de l' anale. Cette nageoire commence immédiatement derrière l'anus; elle est de grandeur moyenne, et presque trois fois plus basse par derrière que par devant; ses deux premiers rsyons sont indivisés et offrent les mêmes proportions relatives que les deux rayons analogues de la dorsale. La dorsale épineuse nait au dessus du huitième rayon de l'anale; elle est de grandeur moyenne et a bord anteriéur arrondi, tandis que les bords postérieur et superieur forment par derrière un angle aigu. La caudale, de grandeur moyeune, est assez profondément échancrée. Les pectorales sont assez reculées vers le bas, et en forme de feuille; elles s'étendent avec leur pointe jusqu' un peu au de la de là distance comprise entre leur aiselle et la base des ventrales. B. 4; D. 10; A. 15; V. 8; P. 14; C. 20, outre les rayons lateraux accessoires.

Quant aux dents de cette espeèe, elles offrent une forme et une disposition trèsparticulières. Il en existe six dans l'intermaxillaire; elles sont minces, peu serrées, coniques et a pointe courbée en arrière. Les dents de mâchoires, au lieu d'être fixées dans ces os, sont mobiles, et sortent avec leur couronne entre la lèvre et le bord extérieur des mâchoires; elles sont disposées un peu obliquement, sur une seule rangée, et au nombre de quatorze sur chacun des bords des deux mâchoires, en sorte qu'il y en a cinquante-siz en tout; ces dents sont assez comprimèes, un peu taillées en biseau, et composées chacune d'une vingtaine de lamelles assez minces et ransversalement disposées. On ne voit pas de dents se former, mais il en existe une bande en velours de chaque côté des palatins. L'os lingual est également couvert de dents en velours, et il se prolonge par devant en une petite pointe émoussée et cartilagineuse; cet organe, peu propre à remplir les fonctions de la langue, est précédé d'un organe d'une disposition trout a fait particulière, et qui parait représenter le véritable organe du goût. Cet organé, placé a l'entrée dela bouche, entre les branches de la mâchoire inférieure, est membraneux et dans la forme d'une crête perpendiculaire dont les parois se séparent vers le derrière, pour se recourber ensuite vers le devant où elles sont rèunies a leur base avec le muscle genio-hyoide; des trois poches qui naissent par suite de cette disposition, les deux latérales s'ouvrent par devant, tandis que la posterieure a son entrée située vis a vis de l'os lingual.

Ce Saumon est orné, a l'état frais, de teintes peu vives, mais assez agreables. Le dessus du tronc et de la queue est d'un verdâtre pâle, passant au blanchatre sur les parties inférieures du poisson. La tête est d'un lilas sale et très-pâle. On voit sur les flancs, derrière la pectorale, une tache verticale jaunâtré, et il existe une tache semblable, mais mal déterminée sur le bord des préopercules. L'iris de l'aeil est d'un blanc argenté. Les pectorales et la caudale sont d'un brun pale. Les ventrales, l'anale et l'adipeuse sont d'un noirâtre tres-pâle, mais cette dernière a son bord supérieur orné d'un liséré cramoisi, tandis que l'anale est bordée en bas de jaune orangé; la dorsale est d'un brun-rougeâtre, et les membranes de sa moitié posterieure tirent au noir vers le haut.

Il ne nous est parvenu aucun détail sur la manière de vivre de ce poisson, don on voit une digure

faite sur le vivant, a la planche CV, fig. l, de notre ouvrage. La figure l a, de la même planche, représente la portion antèrieure de la mâchoire supérieure, quatre fois plus grande que de nature. La langue de ce poisson est figurée de grandeur naturelle, sous n^0. l b, vue de coté, sous n^0 l c, vue en dessus.

Description: Head $4\,^3/_5$ in length; depth $4\,^1/_2$; depth of caudal peduncle $2\,^1/_2$ in head; eye 5; snout $2\,^5/_6$; maxillary $1\,^3/_4$; D. 10; A. 15; scales in lateral series 156, between lateral line and insertion of dorsal 18.

Body elongate, a little compressed, covered closely with small adherent scales of cycloid.

Head small; the snout pointed; eye placed high; mouth oblique; maxillary extending beyond eye a distance a littlle greater than diameter of pupil; the sheath of the upper jaw longer than that of the lower.

Teeth in young specimen villiform on both jaws, peculiarly modified as serrated plates in older specimen with six sharp canines on premaixllary, they cardiform on tongue but without their presence on vomer and palatine. Palatine teeth are present, though very small. Height of dorsal contained $6\,^1/_2$ times in length; anal $8\,^1/_2$; length of caudal $5\,^1/_3$; pectorals 7; ventrals 8.

Dorsal fin is high and median followed by a small adipose in opposite of the posterior base of anal, the pectoral fin is closely placed to the gill opening, the ventral is thoracic opposite the dorsal. Sexual characters of the fish in the anal fin is that the male anal fin is triangular against the high and longer of the female; the caudal fin is large and well-forked.

Table 29. Measurements of *Plecoglossus altivelis* TEMMINCK et SCHLEGEL.

Collection	Fish. Mie Univ.*				
Total length	162.0mm.	142.0mm.	131.0mm.	136.0mm.	141.0mm.
Body length	139.0	121.2	110.0	115.3	120.0
Body length/Head	4.24	4.25	4.23	4.31	4.29
Body length/Depth	4.75	5.05	5.20	5.16	5.00
Body length/Predorsal length	2.10	2.05	2.04	2.13	2.07
Body length/Prepectoral length	4.41	4.49	5.23	4.79	4.61
Body length/Preventral length	2.03	2.05	2.08	2.06	2.04
Body length/Preanal length	1.32	1.38	1.36	1.37	1.33
Head/Snout	2.99	3.08	3.06	3.22	3.12
Head/Upper jaw	1.82	1.73	1.75	1.83	1.77
Head/Interorbital width	3.28	2.94	3.20	3.03	2.95
Head/Diameter of Eye	5.46	5.17	4.55	4.60	4.67
Head/Length of Caudal peduncle	1.77	1.60	1.81	1.66	1.61
Head/Depth of Caudal peduncle	2.74	2.85	2.89	2.78	2.69
Head/Length of Dorsal fin	1.85	2.06	1.92	2.02	2.03
Head/Length of Anal fin	1.66	1.67	1.57	1.70	1.70
Head/Height of Dorsal fin	1.46	1.41	1.42	1.46	1.40
Head/Height of Anal fin	1.89	1.86	1.86	1.91	1.81
Head/Pectoral length	1.50	1.50	1.55	1.50	1.51
Head/Ventral length	1.77	1.81	1.86	1.84	1.87
Date	VIII, 1955				
Locality	River Machiya, Mie Prefecture				

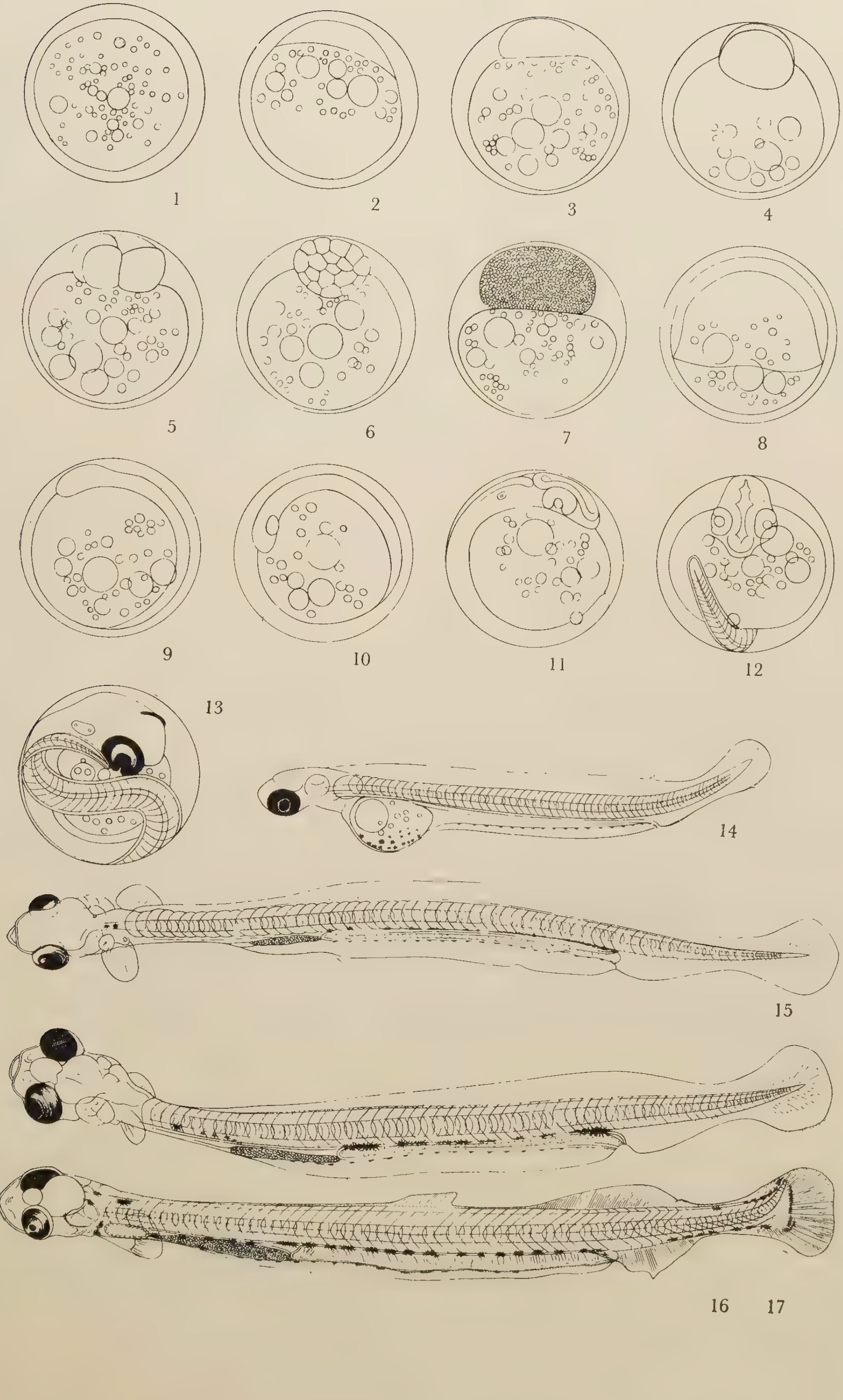
*Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

PLATE XVI

Development of ***Plecogolossus altivelis*** TEMMINCK et SCHLEGEL.

1. Egg, 40′ after fertilization. ×30.
2. Egg, 2°30′ after fertilization. ×30.
3. Egg, 4°30′ after fertilization. ×30.
4. First cleavage, 5° after fertilization. ×30.
5. Second cleavage, 7° after fertilization. ×30.
6. 16 stage, 10° after, fertilization. ×30.
7. Morula stage, 15° after fertilization. ×30.
8. Early embryonal stage, 30° after fertilization. ×30.
9. Further advanced stage, with eye cup, 45° after fertilization. ×30.
10. Embryo with eye cup, 55° after fertilization. ×30.
11. Embryo with statocyst and somewhat differenciated eye, 82° after fertilization. ×30.
12. Embryo, 96° after fertilization. ×30.
13. Further advanced embryo, 173° after fertilization. ×30.
14. Just hatching larva, 230° after fertilization. ×30.
15. Larva, 3 days after hatching, with pectoral fins. ×30.
16. Larva, 20 days after hatching, with developed alimentary canal. ×30.
17. Larva, 44 days after hatching, with differentiated fins. ×30.

PLATE XVI



eggs in a deeper water. The ova are cohesive on the gravel of the bottom and they are colorless translucent of about 1 mm. in diameter.

Larva of about $^1/_5$ of an inch hatch out in about 3 weeks when the temperature of the water is 20°C., and stay in the parent water until they are 2.5 cm long, when they descend into the sea and next year they ascend rivers to spawn after which most of them die; hence perhaps the name "Nengyo" or annual fish. But those that survive the deterioration and can endure the severity of the winter in a deeper water make the reproduction again the following year.

The different names by which the fish is known are "Kogio" or flavorous fish, "Nengio" or annual fish and "Kunisuiwo" or fish of omen. It is gamy and its flavour and sweetenss are much esteemed and prized. Mention of this fish is made as far back as in the region of the Empress Jingu (200 B. C.). In her Korean Expedition, en route at Hizen, she first caught the fish with hook and line and called it. "Ayu" in remembrance of her memorable. "Ayu or the Eastern Expedition" as Korea was then the enemy from the east for China.

It is found in the streams and rivers of Southern Hokkaidô and Honshû. The protective regulation for the culture of this fish for the supply of the Imperial table in the old capitale of Kyôto was executed in the reign of the Emperor Saga (810–824 A. D.).

The annual value of the total catch of this fish generally amounts to more than 50,000 yen, of which the catch in Gifu Prefecture is the largest.

The fishing of this species varies according to the nature of grounds. In rivers and streams where the water is shallow and at grounds suitable for spawning the cast net is used, while the drag net is preferred in river of deep water where the stream is slow and the bottom is of gravelly and sandy.

The "Machi-ami" is a sort of set net. One end of the net is staked to the ground and the other is held across a stream, and then wait for the fish comming down the stream. The "Hane-ami" is the method elswhere described to drive the fish into the net by a scare line. The gill net is used at some grounds besides those already mentioned.

The oldest and most famous method in the country is the cormorant fishing, of which the Nagara River of Mino Province, Gifu Prefecture is the best known place. It has been famous for this method of fishing ever since the reign of the Emperor Jimmu, the founder of the nation over 2,500 years ago. The fish is also caught with hook and line, of which the artificial fly is the latest invention of tackle and will soon be employed everywhere.

"Yana", is a method worth mentioning, which is quite exciting but simple. It is a sort of weir set across a rapid stream with a screen of reeds. This screen is set stream way in slant at the lower course of a stream against the current with which the fish come down and are held there on the screen when the fishermen pick them into the baskets at their watch.

There is another method which seems similar to the live bait fishing in some parts of Europe, but its aim is quite different from that. A live fish is fastened to the hook by its mouth and allowed to swim freely among fisherman hook them up. This method is

called "Tomozuri", meaning to fish with the comparison or the same species."

H. KOBAYASHI observed the development or *Plecoglossus altivelis* at the Tansui Fisheries Experimental Station of Formosa during the beginning of December and the beginning of January in 1923. He described that the egg changes from 0.9 mm to 0.94 mm. in size and the yolk is semitransparent containing light yellowish oil globules. The first cleavage occurs in 5 hours after fertilization; the second in 7 hours and the morula stage appears on 15 hours after fertilization. Early larva is formed in 45 hours after fertilization occupying the half of the yolk sac and eye cup appears on 60 hours after fertilization. Myotomes are numbered 15 in the embryo 65 hours after fertilization and KUPFER's vesicles appear distinctly in this stage. The differentiation of brain occurs and the body is more elongated occupying about 4/5 of the yolk sac, provided with 40 myomeres. In the embryo in 96 hours after fertilization, the ear vesicle is distinct and the myomeres increased in number. The brain is divided into fore, middle and hind parts. The melanophores appear on the eye cup. In the embryo of 110 hours after fertillzation and the pulsation of heart is happened. The embryo occupying about half and one round of yolk sac and the heart is actively beating and otolith appears in the statocyst and myomeres 46 in 130 hours after fertilization. In the embryo of 173 hours after fertilization, the yolk sac becomes smaller and the body rounds about twice of yolk sac. Eye distinct, with black and greenish pigments. Myomeres 56. Alimentary canal is distinct and the anus opens. About ten melanophores appear along the intestine.

Family Osmeridae

Characters: Body elongate, covered with moderate or small scales, which are usually cycloid. Head naked. Mouth terminal, small or large, formed as in the *Salmonidae*, the maxillary forming the margin of the upper jaw. Teeth various, sharp-pointed. Gills 4, a slit behind the fourth. Gill membranes separate, free from the isthmus, with 6 to 10 branchiostegals. No barbels. Stomach a blind sac, with the pyloric coeca few or none. Dorsal fin short, nearly median; adipose fin always present; caudal forked; anal moderate; pectorals placed low, ventrals moderate, nearly median; no spines in the fins. Lateral line present. No phosphorescent spots. Abdomen rounded. Air bladder large, single. Ova large, falling into the cavity of the abdomen before extrusion.

Key to the Japanese genera of Osmeridae

a¹ Mouth large, hyoid and jaws with strong teeth.
  b¹ Vomerine teeth canine like, not cover the whole surface of vomer. .... **Osmerus**
  b² Vomerine teeth not canine like, many arranged along convex line on the whole surface of vomer. .... **Spirinchus**
a² Mouth small, jaws with small teeth or wanting. .... **Hypomesus**

Genus Osmerus (LINNAEUS) LACEPEDE, 1758.

Osmeris LINNAEUS, Syst. Nat., 10th ed., 1758, p. 310.

Osmerus LACEPEDE, Hist. Nat. Poissons, v, 1803, p. 229.
Eperlanus GAIMARD, Voy. Island and Groenland, 1851.
Spirinchus JORDAN et EVERMANN, Fish. N. and M. Amer., 1896, I, p. 522.

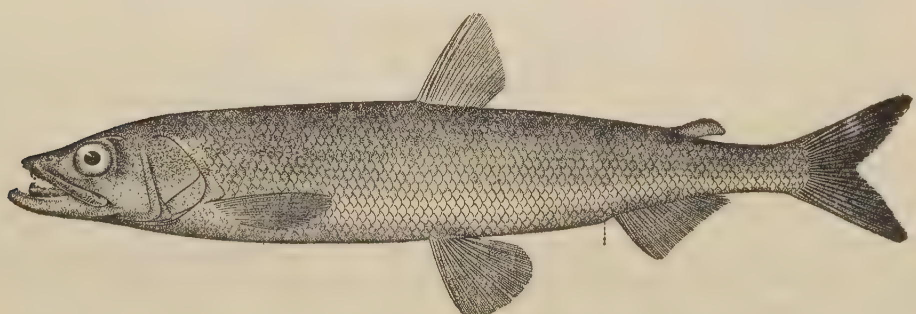
Characters: Body elongate, compressed. Head long, pointed. Mouth wide, the slender maxillary extending to past the middle of the eye; lower jaw projecting; preorbital and suborbital bones narrow. Maxillaries and premaxillaries with fine teeth; lower jaw with small teeth, which are larger posteriorly; tongue with a few strong, fang-like teeth, largest at the tip; hyoid bone, vomer, palatines, and pterygoids with wide-set teeth. Gill-rakers long and slender. Branchiostegals 8. Scales large, loose, 60 to 70 in the course of the lateral line. Dorsal small, about midway of the body, over the ventrals; anal rather long. Vertebrae about 40. Pyloric coeca small, few. Small fishes of the coasts of Europe and northern America, sometimes ascending rivers; delicate in flesh and considerably valued as food.

25. Osmerus dentex STEINDACHNER.

"Kyuriuwo"

(Text-fig. 53)

Osmerus dentex STEINDACHNER, Sitzungsb. Kais. Akad. Wiss. Wien, LXI, 1870, p. 429; (Decastris Bay, northern China). – JORDAN et SNYDER, Proc. U. S. Nat. Mus., 1900, p. 349; Tôkyô Market, Hakodate. – JORDAN et GILBERT, Synopsis, 1883, p. 293. – TURNER, Contr. Nat. Hist. Alaska, 1886, p. 102, pl. x. – NELSON, Rept. Nat. Hist. Coll. Alaska, 1887, p. 313. – JORDAN et HUBBS, 1925, Mem. Carneg. Mus., x, 2, p. 149. – AOYAGI, 1957, Gen. Notes Fre. Fish. Jap. Arch., pp. 53-54, fig. 43.
Osmerus eperlanus ISHIKAWA, Prel. Cat., 1897, p. 19; Nemuro; Tokadzu. (not of LINNAEUS).



Text-fig. 53. ***Osmerus dentex*** STEINDACHNER.

Description: Head 4 in length; depth 6; depth of caudal peduncle $4\,^1/_5$ in head; eye 5; snout $3\,^1/_2$; interorbital space $4\,^1/_4$; D. 10; A. 15; scales in lateral series 70; between lateral line and dorsal 8. Body long, slender, compressed, caudal pedunlce narrow; head long, sharp, pike-like. Snout long, pointed, the lower jaw slightly projecting,

maxillary extending to posterior edge of orbit, its length contained about 2 times in head. Teeth on maxillaries and premaxillaries minute; 2 to 4 large sharp teeth on anterior edge of vomer, a row of smaller teeth on the palatines, and a similar row opposite the latter and extending farther back on the pterygoids; lower jaw with a row of rather large teeth; tongue with fang-like teeth, the anterior ones largest. Pseudobranchiae present; gill-rakers on first arch 9 + 18, very long and slender. Scales large, cycloid, loosely attached. Lateral line straight, extending along middle of body. Dorsal inserted near middle of body, its longest rays contained $1\,^{2}/_{3}$ in the head; height of anal $2\,^{3}/_{4}$; caudal deeply forked, $1\,^{1}/_{3}$ in head; pectoral rays 12, the longest $1\,^{2}/_{3}$ in head; ventral rays 8, 2 in head.

Table 39. Measurements of *Osmerus dentex* STEINDACHNER.

Collection	O. H. B. S.*	
Total length	212.0 mm.	214.0 mm.
Body leugth	184.0	186.0
Body length/Head	4.38	4.38
Body length/Depth	6.35	5.32
Body length/Predorsal length	2.64	1.98
Body length/Prepectoral length	4.20	4.33
Body length/Preventral length	1.89	1.95
Body length/Preanal length	1.31	1.30
Head/Snout	3.42	3.28
Head/Upper jaw	1.95	1.89
Head/Interorbital width	3.81	3.82
Head/Diameter of Eye	4.95	5.12
Head/Length of Caudal peduncle	2.27	2.12
Head/Depth of Caudal peduncle	3.81	3.60
Head/Length of Dorsal fin	2.34	2.02
Head/Length of Anal fin	1.80	1.81
Head/Height of Dorsal fin	1.53	1.60
Head/Height of Anal fin	2.43	2.69
Head/Pectoral length	1.40	1.37
Head/Ventral length	1.83	1.70
Date	IX, 1915	
Locality	River Ishikari, Hokkaidô	

* Ôtsu Hydrobiological Station, attached to Kyôto University.

Color in alcohol, brownish above, white below, the sides silvery; scales narrowly edged with brown except on the ventral surface of body. In life back pale olive, the scales edged with darker; sides above lateral line purple, changing to blue, violet, and gold; belly satin white; fins slightly golden.

A fish brilliantly colored in life, the flesh of firmer texture than in the rest of the genus. Coast of Alaska south to Manchuria and northern Japan, abundant northward; our specimens are from Kushiro, Hakodate, and the market of Tôkyô, whether they may have been brought from the north.

Distribution: The present species is distributed in Berlin Sea coast, Hokkaidô, Saghalien, Karafuto, Eastern coast of Korea. River Nishibetsu, River Kushiro, River

Tokachi (NOZAWA); River Shinkan, River Yurabe; Kunashiri Island (SOEDA); Kushiro, Hokkaidô (JORDAN & HUBBS).

Remarks: In the north Pacific coast, the fish closes to the shore in school and moves along the coast to get a spawning ground. From the middle of June the fish begins to spawn and it continues to the end of July. The eggs are deposited on seaweeds at the tidal zone. The food of adult fish is mostly crustacean as shrimp.

Genus **Hypomesus** GILL, 1862.

Mesopus, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 168.
Hypomesus, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 169.

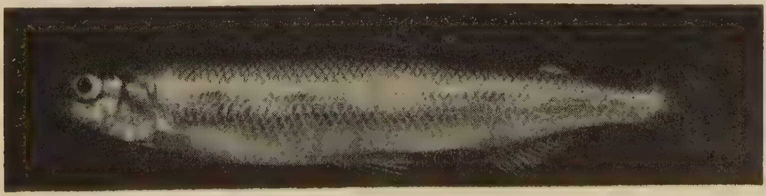
Characters: Body rather elongate, moderately compressed covered, with thin scales of moderate size. Head rather pointed. Mouth moderate, the shortish maxillary not extending quite the middle of eye; its outline below broadly convex; lower jaw projecting. Teeth minute, on jaws, vomer, palatines, pterygoids, and tongue. Ventrals inserted directly under middle of dorsal, midway between eye and base of caudal. Branchiostegals 6 to 7.

Key to Japanese species of Hypomesus

a^1. Ventral fin inserted at the first ray of dorsal fin; anal fin 16; dorsal fin 8-9. .... **Hy. olidus**
a^2. Ventral fin inserted at the second or third ray of dorsal fin; anal fin 12-13; dorsal fin 10. .... **Hy. japonicus**

26. **Hypomesus olidus** (PALLAS).
Pond smelt, "Wakasagi"
(Text-fig. 54)

Salmo olidus PALLAS, 1811, Zoogr. Ross. Asiat., III, p. 291.
Mesopus olidus GÜNTHER, Cat. Brit. Mus., VI, p. 169 - JORDAN et SNYDER, 1901, Proc. Nat. Mus., vol. 24, no. 1265, pp. 588-589. - MATSUBARA, 1908, Nihon Gyokairui Zusetsu, pp. 94-95. - OTAKI, 1907, Nihon gyorui Zusetsu, p. 42.
Hypomesus olidus JORDAN et GILBERT, 1883, Synopsis, p. 295. - TURNER, 1886, Contr. Nat. Hist. Alaska, p. 103. - ISHIKAWA, 1897, Prel. Cat., p. 19. - JORDAN et EVERMANN, 1896, Fishes N. and



Text-fig. 54. ***Hypomesus olidus*** PALLAS.

M. Amer., I, p. 525. -JORDAN, TANAKA et SNYDER, 1913, Jour. Coll. Sc., Imp. Univ. Tokyô, vol. 23, art. 1, p. 45. - OKADA et IKEDA, 1938, Saitô Hô-on kai Mus., R. Bull., no. 15, pp. 39-40. - OKADA et MAKAMURA, 1948, Nihon no Tansuigyo, pp. 142-143, fig. 60. - TANAKA, 1921, Nihon Gyogaku, p. 290. - EBINA, 1931, Nihon Zyûyo Gyorui Zûshyô, pl. 67. - OKADA et IKEDA, 1938, Saitô Hô-on kai Mus. Res. Bull., no. 15, pp. 89-90. - OKADA et IKEDA, 1938, Scien. Rep. Tôkyô Bunrika Daigaku, sect. B, no. 55, pp. 144-145. - AOYAGI, 1957, Gen. Notes Fre. Fish. Jap. Arch., pp. 56-57, fig. 44.

The original description is as follows:

Salmo olidus* Tab. lxxxi, fig. 3.

S. (*Osmerus*) corpora argenteo sudmacrolepidote, maxillis subsequalibus pinna ani sedecimradiata.

Osmerus pinna ani sedicim, dorsi novem radius, Steller obo. Ms. Camtschadalis Inniacha.

Frequeno pisciculus in fluviis et lachus Camtchatcae, ubi autumno et circa initium Sprilis copiose capitur, variis que modis praesertim in fl. Camtchatea et Opposite Tigil. In foeminis tune ova transparent. Totus maleolet, ut S. *spirinchus*, attamen recentes frixati satis gratum cibum praebent. In aliis Siforiae aquis deest. out non obsewatm frist.

Deser. Longitude quatmor cum dimidio pollicum, vixultra. Caput oblongum, rostro conoides; maxillae subaequales, inferior resina, adscendens; Dentes mimdi in marginibus maxillarum et duplici sene in palato: lingua asperata. Nares geminae, media ad oculoe distanta. Aculi majusculi, iride argentea, pupilla rotunda. Valva branchialis rotundata, argentata; Flabella branchialia septemlamellata. Corpus teretensculum. dorso convexum submacrolepidotum; Aquamae temissimae, laeves, facillimae deciduae. Color argentatum, punctis minutis pulveratus, in dorso gryseo-fuscur. Liner lateralis recta, dorso propior. Pinnae ownes, praeter caudam, Albescentes, dorsalis 9 randioram, quarum priores duo simplices; adiposa tenuissima, hyahia, P. pectoralis rad. 11; ventrales 8. primo simplici; ani rad. 15-16. appendiculis non stipatae. Cauda admtum forcipata, fusca. In pisce longo 4". 9"', caput 10"'.

Not. *Salmo saurus* LIN. ad *Osmeros nequaquam* pertivetquippe lobulo ad pinnas ventrales instructus, qua Osmeri omnino carent.

C. corregoni; subdentuli, subedentuli, submacrolepidoti, squamula ad pinnas ventrales, cauda furcata.

Description: Height of body 5 times, head $4\,^1/_2$ times in the total length; snout $8\,^1/_2$ times and the diameter of eye $4\,^1/_2$ in head. Dorsal 11; Pectorals 14; Ventrals 8; Anals 17; Caudals 24; Lat. $^1/_8$ 60.

Body elongate and not much compressed with a small head which is rather pointed; eye being moderately large and advanced; mouth is low and with wide cleft, lower jaw a little projecting; small teeth on both jaws in a single series, those on tongue in double series, being viliform on vomer and palatine. Dorsal fin is median and small followed by a small adipose fin; the pectoral and ventral small, the latter being thoracic in opposite of the adipose; the caudal fin small and deeply forked.

Dorsal color is pale greenish blue and silverly white below with a transverse silver band on the entire length of the side.

Remarks: This delicate fish is originally a northern form, but recently it is breeding in the southern part of Japan. From our examinations, the southern limit of transplantation of this fish seems to the Ikeda-Ko and Unagi-Ike, Kagoshima Prefecture, Kyushû in Japan. The fish have been introduced into many lakes, as Lake Suwa, Lake Yamanaka, Nagano Prefecture and Lake, Haruna, Tochigi Prefecture, from Lake Kasumigaura

*PALLAS, 1811, Zoogr. Ross. Asiat. III, pp. 391-392

Ibaraki Prefecture. They feed on pelagic small animals. The breeding season from January to March. They deposit eggs on water plants in shallow waters of lake.

Table 31. Measurements of *Hypomesus olidus* (PALLAS).

Collection	O. H. B. S.*				
Total length	124.0mm.	122.0mm.	136.0mm.	118.0mm.	132.0mm.
Body length	110.0	106.0	116.0	102.0	112.0
Body length/Head	4.58	4.70	4·07	4.37	4.23
Body length/Depth	6.12	4.80	5.16	5.23	5.84
Body length/Predorsal length	2.07	2.08	2.00	2.13	1.97
Body length/Prepectoral length	4.57	4.70	4.38	4.38	4.58
Body length/Preventral length	2.02	2.08	2.09	2.17	2.04
Body length/Preanal length	1.37	1.38	1.38	1.42	1.37
Head/Snout	3.70	3.71	3.66	3.88	4.02
Head/Upper jaw	2.24	2.56	2.64	2.59	2.65
Head/Interorbital width	4.00	4.18	4.38	4.24	4.27
Head/Diameter of Eye	4.35	4.61	4.38	4.02	4.41
Head/Length of Caudal peduncle	2.00	1.92	2.03	1.85	2.41
Head/Depth of Caudal peduncle	2.81	3.06	3.53	3.59	3.89
Head/Length of Dorsal fin	2.66	2.56	3.00	3.19	2.94
Head/Length of Anal fin	1.39	1.46	1.83	1.60	1.83
Head/Height of Dorsal fin	1.33	1.41	1.46	1.71	1.52
Head/Height of Anal fin	1.65	2.09	2.22	2.33	1.21
Head/Pectoral length	1.47	1.41	1.58	1.46	1.56
Head/Ventral length	1.60	1.71	1.90	1.66	1.83
Date	1923				
Locality	Lake Ikeda, Kyûshû				

* Ôtsu Hydrobiological Station attached to Kyôto University.

Table 32. Measurements of *Hypomesus olidus* (PALLAS).

NO.	S.L.	D.B.	H.	S.	E.	I.S.	M.	D.C.	S-D.	S-V.	NO. F.R. D.	NO. F.R. A.	P.D.	NO. S. L.L.	NO. S. A.L.	NO. S. B.L
	mm.	inS.L.	inS.L.	inH.	inH.	inH.	inH.	inH.	inS.L.	inS.L.						
5419	99.4	5.8	4.0	4.1	4.3	4.9	2.4	3.7	2	2						
——	104.3	5.8	4.4	3.5	3.6	3.8	2.2	3.4	2	2	10	16+1	29	60	7	7
15142	95.0	5.5	4.0	4.0	4.1	4.1	2.3	3.6	2	2.1	10	16	27	55	6	6
15776	88.3	5.6	4.1	3.9	3.9	4.3	2.5	3.6	2	2.1	10	18	28	57	7	6
——	95.7	5.7	4.3	3.4	3.7	3.9	2.3	3.7	2	2	10+1	27	27	57	7	6
15893	67.0	6.7	3.9	4.0	3.3	4.0	2.5	3.9	2	2	9	17	26	57	7	7

NO. …… Number of the specimens preserved in the Saitô-Hôon Kai Museum, Sendai, Miyagi Prefecture; S.L. …… Standard length (= Body length exclusive of caudal fin). D.B. …… Depth of body; H. …… Head; S. …… Snout; E. …… Eye; I.S. …… Inter, orbital space; M. …… Maxillary; D.C. …… Depth of caudal peduncle; S-D. …… From the tip of snout to the first dorsal ray; S-V. …… From the tip of snout to vent; NO.F.R. …… Numbers of fin rays; NO.S. …… Numbers of scales; D. …… Dorsal; A. …… Anal; P.D. …… Predorsal; L.L. …… In lateral line; A.L. …… Above lateral line; B.L. …… Below lateral line; in S.L. …… in standard length; in H. …… in Head.

ÔTAKI* mentioned the habits of fish and fisheries as follows:

"When full grows it attains to a size of about $^1/_3$ of a foot. It is found northward. It scatters about the shores and in about September ascends rivers and estuaries when it is as about $^1/_6$–$^1/_4$ of a foot large. The spawning season is about the period of Decem-

* ÔTAKI, 1907, Nihon Gyorui Zusetsu, p. 42.

ber to January. The spawning bed is the bottom of waters of about 9 feet deep where the growth of vegetation is rich. The eggs are about 1 mm. in diameter. They stick themselves to the dead leaves of the bottom vegetation when they are deposited. The larva of about 1 mm. in diameter hatch about 12 days in water at the temperature of 10°C. They at first swim about in congregation in the sunny water, and they go down the stream into the sea when they grow a little larger, where they remain until next year. It may be presumable that the spent fish die after their spawning as any other Salmonidae.

The apliances used for this fishery are mostly drag nets, of which the Dai-toku net and the Hobiki net are used in Kasumigaura, a large lagoon in Mito Province on the Pacific coast during the long period of July to next April, and July to September respectively. They are a kind of small sized trawl with pocket. The one is dragged at the bottom by rowing in a small boat while the other by means of a sail, the latter method becoming more common and increasing in number of boats against the former as it is easier in prosecution and needs less hands in a boat."

Distribution: Sakhalin; Hokkaidô; Northern part of Japan, Kankyôdô, Korea; Amur; Kamchatka; East Alaska; Maritime. Lake Kawaguchi, (Musashi ISHIKAWA); Lake Yamanaka; Nagano (NAKANO); Lake Suwa (JORDAN); Lake Mikata, Fukui; Akita; Aomori (BEPPU); Iwate (AWAYA); Aomori, Same, Matsushima, Hitaka, Nemuro; Kaga; Tsuchiura (JORDAN & SNYDER); Lake Kasumigaura (HATTORI); Lake Suwa (JORDAN et HUBBS); Lake Biwa; Lake Kawaguchi (TANAKA); Lake Hanare, Lake Asamo, Kyotofu; Lake yogo, Shiga Prefecture (MIYAZI); Kasumigaura, Kitaura; Hishinuma; Hachirogata, Akita Pref., Kohokugata, Ishikawa Pref., Mikatanuma, Shinjiko Shimane Pref. (EBINA);Yoichi, Hokkaidô (HIKITA); Lake Ikeda, Kagoshima Prefecture (TORII& KAWAMURA); Kasumigaura, Ibaraki Prefecture (WATANABE); Shibetsu Numa, Kunashiri-tô, (HOSHINO); Shibutchari Numa, Kunashiri-tô (MIYADI); Lake Ikeda, Ike Unagi, Kagoshima Prefecture; Akita Prefecture; Miyagi Prefecture (OKADA & IKEDA), Lake Mokoto, Hokkaidô (OKADA & IKEDA).

27. **Hypomesus japonicus** (BREVOORT).

"Chika"

(Text-figs. 55, a–b)

Osmerus olidus BREVOORT, 1856, Exped. Japan, p. 278, pl. 10, fig. 2.

Osmerus oligodon KNER, 1865, Fische. Natur. Museum, Godeffroy, p. 9, pl. 14, fig. 1.

Mesopus olidus GÜNTHER, 1866, Cat., VI, p. 169.

Mesopus japonicus JORDAN et SNYDER, 1902, Proc. Nat. Mus., pp. 589–590.

Hypomesus olidus EVERMANN et GOLDSBOROUGH, 1907, Bull. Bur. Fish., vol. 26, p. 270, fig. 18.

Hypomesus japonicus JORDAN, TANAKA et SNYDER, 1913, Jour. Coll. Sci. Imp. Univ. Tokyô, p. 46· –JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, No. 2, p. 152. --TANAKA, 1921, Nihon Gyogaku, p. 290.

The original description is as follows:

Osmerus olidus ? PALLAS.*

Notes. - From Hakodadi, (6 1/4 inches. Ugoi).

No species smelt is described in the Fauna Japonica, and as the fish noticed in that work seem to have been collected around the southern shores of Japan, it is probable that it is not found so far south.

DIENGKITSCH pronounced MEDHURST'S name for the smelt, Kisgo, to be erroneous, and also said that Ugoi was not its true name. Ugoi, or Foogoi, means that it is not a carp, but he could not remember the name of the smelt.

Many Russian travellers have noticed smelt in the Pacific, and describe two species of *Osmerus* and one of *Mallotus*. Mr. COLLIE appears to have met with two species of *Osmerus* in Awatscha Bay, according to the notes on page 49 of the Zoology of BEECHEY'S Voyage in the Blossom. PALLAS seems to have supposed that the *Osmerus eperlanus* and *Spirinchus* of Europe were also found in the Pacific, which M. VALENCIENNES seems to admit, though the species can hardly have so wide a range. PALLAS describes an *Osmerus olidus*, as peculiar to the Pacific, which is not noticed or even quoted in the Hist. des Poissons. In the absence of more certain data, it is assumed to be the fish herewith figured, though the species is said by PALLAS rarely to exceed a length of four and a half inches. It is the first time that an *Osmerus* from the North Pacific has been figured. Specimens of this and of other species, if any exist, will no doubt be found among the collections brought home by the North Pacific Surveying Expedition.



Text-figs. 55. a. ***Hypomesus japonicus*** (BREVOORT). ♂ ×1
b. ***Hypomesus japonicus*** (BREVOORT). ♀ ×5/4

Description: Head 5 in length; depth $5\,^1/_2$; depth of caudal peduncle 3 in head; eye 4; interorbital space $3\,^3/_4$; snout 4; D. 9; A. 13; scales in lateral series 65, in transverse series between ventral and dorsal 14.

Body long, somewhat compressed, the head short and pointed. Interorbital space broad, flat, or slightly convex. Snout about equal in length to diameter of orbit, pointed,

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* Notes on some figures of Japanese Fish taken from recent specimens by the Artists of the U. S. Japan Expedition, 1856, p. 278, pl. x, fig. 2.

the lower jaw slightly projecting; mouth small, the maxillary extending to a vertical through anterior edge of pupil, lower outline of maxillary convex, rounded posteriorly. Teeth minute, on jaws, vomer, palatines, pterygoids, and tongue, those on the tongue largest. Pseudobranchiae present. Gill-rakers on first arch $9+21$, very long and slender. Scales large, smooth, easily displaced; they to caudal base, 66 to 68. Lateral line not very conspicuous, passing along the eighth series of scales below dorsal. Dorsal inserted near middle of body, half way between tip of snout and base of caudal fin, the anterior rays highest, $1\,^2/_5$ in head. Anal low, the highest rays $2\,^2/_3$ in head. Caudal deeply forked, about equal to length of head. Ventrals inserted a little behind the dorsal origin, $1\,_2/^1$ in head. Pectoral rays 13; length $1\,^2/_5$ in head. In alcoholic specimens, the body shows a broad, silvery lateral band just middle of the lateral side of body, the scales on upper half of body edged with dusky dots, the top of head dark.

Distribution: Kushiro, Hokkaidô (JORDAN & HUBBS); Hakodate (BREVOORT); Kushiro, Hokkaidô; Aomori Prefectrue (JORDAN & SNYDER); Decastris Bay, Manchuria (KNER).

Genus **Spirinchus** JORDAN et EVERMANN, 1896.

Spirinchus JORDAN et EVERMANN, 1896, Fish. North. Midd. Amer., pt. 1. –HUBBS, 1925, Proc. Biol. Soc. Wash., 38 : 53.

Type = **Osmerus thaleichthys** AYRES

Characters: Body elongate, laterally compressed; haed long, pointed at end; mouth broad; upper mandible slender, long, beyond posteriorly the middle of eye; preorbital and suborbital narrow; main mandible and premandible with minute teeth and lower maxillary with small teeth; few, strong, pointed teeth on tongue; teeth on hyoid, palatines and pterygoids. Vomerine teeth somewhat many in number, arranged in convexed linear line along the outline of cranium. Branchiostegals slender, long; branchial rays 8 in number; scale large, 60–70 on lateral line. Dorsal fin small nearly on the middle of body, reaching far beyond ventral fin; anal fin somewhat long. Vertebrae 40 in numbers. Pyloric coeca small, few in numbers.

28. **Spirinchus lanceolatus** (HIKIDA).

"Shisyamo"

(Text-figs. 56, a–b)

Osmerus lanceolatus HIKIDA, 1913, Zool. Mag,. vol. 25, no. 293, pp. 127–129, pl. 4, text-fig. 1. – HUBBS, 1925, Proc. Biol. Soc. Wash., 38: 53–54.

Spirinchus lanceolatus JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 149–151.

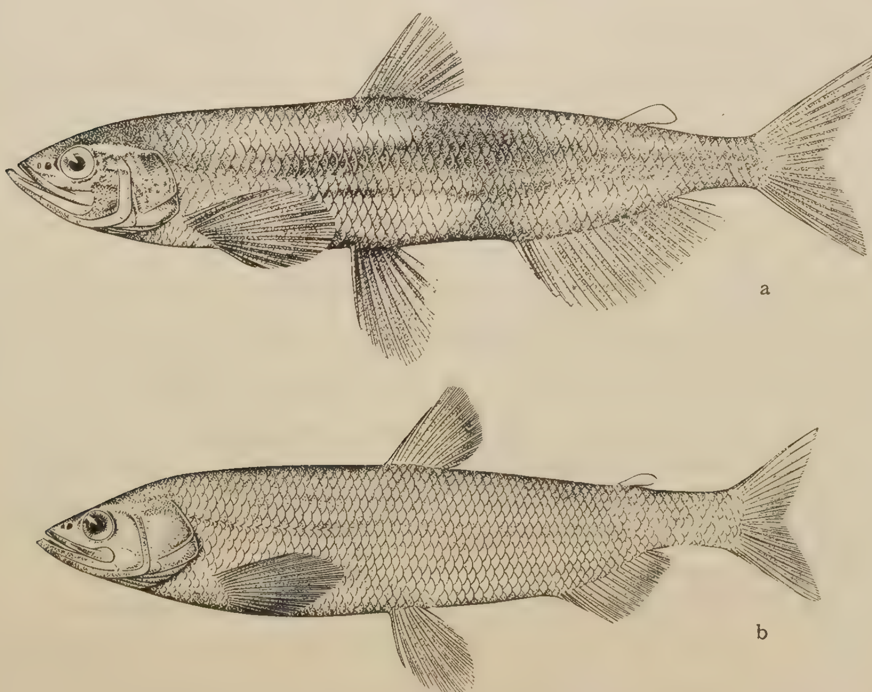
The original description* is as follows.

Body length $4\,^1/_3$ in head length $5\,^1/_3$ in body height; head length $4\,^2/_3$ of eye diameter; $4\,^2/_3$ in snout length; $3\,^1/_3$ of interorbital space; $3\,^1/_3$ of the height of caudal peduncle. Branchial rays 7. Dorsal 10-

*HIKIDA, 1931, Zool. Mag., vol. 25, no. 293, pp. 127–127, pl. 4. text-fig. 1.

11 rays, pectorals 11–12, ventrals 8, anals 17–20, caudals 19 rays. Pyloric coeca 3–5; vertebrae 60–63; ribs 33. Lateral on the scales of anterior part of body; pores 14–18; scales on the lateral line to the base of caudal fin 61–63; upper 7, lower 9 on the transverse row of the lateral line, just front of anus.

Body elongate and compressed. Caudal peduncle very compressed laterally; straight along the upper margin of body and somewhat curved along the lower margin; two long ridges on both sides of body in male, contained colourless transparent mucous inside; one is measuring 3 cm. in height and 4 cm. in breadth, running along the lateral line from the back of opercle to the origin of adipose fin, the other is measuring 3 cm. in height and 8 cm. in breadth, running obliquely from the back of the base of pectoral and to the front of ventral fins. Snout rounded on the tip; eye large; interorbital space broad and convexed; nostrils closed together on both sides opened nearer the anterior edge of eye than the tip of snout; the anterior nostril with somewhat elevated margin; the posterior nostril larger than the anterior. Mouth large and obliquely opened. Upper mandible broad and thin, curved along the edge, the posterior edge reaching to the posterior margin of pupils; lower mandible projected, curved upward at the end. Dorsal and ventral fins inserted from the same place on both sides; the third ray of the dorsal fin very long; the pectoral fins narrow, round at the posterior margin, the fifth ray longest, its end not reached the ventral fin; ventral fin rounded at the posterior margin; the sixth ray longest, its end not reached the anal fin. In the male, the anal fin larger that of the female, the margin of the anal fin convexed and the tenth ray longest while the margin of the anal fin not convexed and the fourth ray longest in the female. Teeth on both mandibles, vomer, palatine, pterygoid, hyoid, pharyngeal, very small; teeth on the upper mandible in one linear series distributed along the entire margins of premaxillary and upper mandible. Teeth on the upper mandible more densely distributed than those on the premaxillary, teeth on the lower mandible in double linear series, the inner teeth somewhat longer than the outer. Vomerine teeth and palatine teeth arranged in linear series, somewhat longer than those of the inner teeth of the lower mandible. Vomerine teeth only on



Text-figs. 56. a–b. ***Spirinchus lanceolatus*** (HIKIDA).
a. Male b. Female

the tip of vomer, 4–8 in numbers. Hyoid and palatine teeth very large and strong, especially the teeth on the basi-hyal extremely large and canine like, 8–13 in numbers. Pharyngeal teeth nearly the same size of the upper mandibular teeth. Upper pharyngeal teeth in two linear series; five in left side of the outer series and 4 in the right side while 15 in left side of the inner series and 14 in the right side. Lower pharyngeal teeth arranged in one linear series, 11 in the left side and 11 in the right side.

Color in fresh light black in male and very faint greyish in female; light olive on the back with pinckish colour; silver on both sides. Fins also have the same colour of the body; the ventral fin silver with small black spots. Pearl organs appeared on head and back, especially numerous on the head of male. Pyloric coeca present, few in numbers, the longest 1.7 cm. and 2 cm. in the shortest; air bladder somewhat longer connected to oesophagus with duct.

Description:* Dorsal rays, 2, 8 (2, 9 in one specimen); anal rays, 4, 16 (3 or 4, 15 or 16); pectorals, 11 (11 or 12); ventrals, 8 (constant); scales 7–62 to 65–8 to 10; length of head to end of opercular membrane, 4.35 (4.4 to 4.6) in length to caudal base; depth of body, 5.3 (to 5.4 in males; 4.65 to 6.0 in ripe females); least depth of caudal peduncle, 3.0 in head (3.0 to 3.2); snout, 4.5 (4.4 to 4.6); upper jaw, 2.1 (2.0 to 2.15) not longer in male than in female; mandible, 1.95 (1.8 to 2.0); orbit, 4.5 (4.2 to 4.6); eye 5.6 in breeding male, larger in females; fleshy interorbital, 3.35 (male); bony interorbital, 4.6 (4.2 to 4.7).

Body of breeding male oblong, the greatest depth being almost evenly maintained from the shoulders to the anal fin, behind which point the central contour rises rather sharply upward to tip of the projecting mandibles; dorsal contour much flatter, weakly concave behind eyes, but a little convex on snout. Tip of mandible on level of middle of eye, tip of premaxillaries somewhat higher. Interorbital space weakly convex; suborbital narrower than the upper jaw, which has a concave upper border and a tip more rounded dorsally than ventrally; maxillary extending to below posterior border of eye. Branchiostegals 4–3; gill rakers, 11 + 26 = 37, the longest, 1.6 in orbit. Pyloric coeca four, of very unequal length. Teeth weak for a smelt; tongue covered with strong, but rather short teeth, of which four of five around the tip are somewhat enlarged, scarcely canine-like. Other teeth arranged in single file, those of premaxillary and mandible of moderate size, rather close-set, those of maxillary very fine; those of vomer, palatines, and pterygoids very small canines; each side of the vomer and each palatine bone with four or five of these teeth.

Breeding males are all very dark in color, dusky above the blackish lateral stripe, which extends along and just above the lateral line; scale margins ventrally dark; top of head dark, becoming blackish on the snout, rest of head heavily punctate with black; dorsal fin dusky, blackish on the frontedge; adipose pale; caudal blackish throughout; anal black on basal half; ventrals dusky, with dark specks medially; pectorals dark, blackish on upper border. Females pale in color, showing the same markings.

In the breeding male, the entire head and body and both sides of all the fins except the caudal and adipose are thickly covered with small warty pearl-organs, not represent-

* JORDAN and HUBBS made the description of *Spirinchus lanceolatus* from the observations on the specimen labelled *Osmerus lanceolatus* collected at Iburi, Hokkaidô, presented to Dr. JORDAN by Dr. TAMIJI KAWAMURA.

ed in the females, even by rudiments. The skin is everywhere turgid, the scales being particularly soft and thick. The lower fins are greatly expanded and lengthened in the breeding male; the pectorals reaching to within less than the length of the eye from the insertion of the ventral fins, which in turn extend to (or nearly to) the origin of the anal, each fin being nearly as long as the head; the anal, when depressed, reaches to the root of the lower caudal rays, and its longest rays are contained 1.6 to 1.7 times in head. The membranes of these lower fins are widened and the rays thickened, so that the fins are spread in fan-like fashion. In the females, each of the lower fins falls short of the next fin by a distance about equal to the length of the eye, and the highest anal ray is only two-fifths as long as the head. Our breeding males are 134 to 148 mm. long to caudal fin; ripe females 129 to 136 mm.

Distribution: River Omu, Iburi Province, Hokkaidô (Type locality), Iburi, Hokkaidô; Kushiro, Hokkaidô (JORDAN et HUBBS); River Ômu, Iburi Province; River Saru, Hidaka Province; River Tokachi, Tokachi Province; River Kushiro, Kushiro Province; River Oboro, Akkeshi; River Urup, Yakumo, Hokkaidô (INUKAI).

Remarks: T. HIKIDA described the present species from the specimen collected at River Ômu, Iburi Province, Hokkaidô, on 3rd of November, 1912. He remarked that this species closely resemble, with *Osmerus attenuatus* LOCKINGTON but different by the numbers of fin rays and scales and other characters. The fish usually distributing in a group in the sea and on November and December, they ascend the river in night during definite day in this season to spawn in shallower water on the sandy pebble bottom. They do not ascend within 10 miles from the entrance of the river and reached spawning ground within few days. After spawning, they soon descend into sea. About 4033 eggs contained in female measured 12.5 cm. in body length.

Secondary sexual characters: In male, two broad, elevated stripe zones run from anterior to posterior along the middle of lateral side. The upper zone begins from the posterior margin of gill cleft to the origin of adipose fin and the lower zone runs obliquely from the base of pectoral fin to the anterior ventral fin. The female is quite lacking in this stripe zone. The female has a somewhat longer and broader head pointed at the end than the male. The anal fin of the male is much larger and rounded at the margin while that of the female small and truncated at the end. The male is dark and the female white. Many pearl organs appear on the head and back of both sexes.

Family Salangidae

Characters: Head depressed, flat above; body elongated, deepest at origin of anal subcylindrical anteriorly, and compressed posteriorly; abdomen round, with longitudinal membranous fold running along median line between base of ventrals and anus, and no scale except row of adherent scales above base of anal in male. Teeth conical, always present on both jaws, and absent on vomer. Branchiostegals four in number; pseudobranchiae well developed. Dorsal fin placed far behind ventrals with 7 rays; adipose fin small and membranous, pectorals with fleshy pedestral. Alimentary canal straight, without pyloric appendage. Air bladder always present.

Subfamily Protosalanginae

Protosalanginae, WAKIYA et TAKAHASHI, 1937, Journ. Coll. Agr. Tokyo Imp. Univ., vol. 14, no. 4, p. 271.

Characters: Premaxillaries normal, having no anterior expansion; maxillaries extending beyond anterior margin of eye; dentaries without bony process near symphysis; head weakly depressed; lower jaw projecting, but not ending in presymphysial appendage; premaxillary teeth numerous (average 34); no symphysial canines on symphysis of lower jaw; pectoral rays more than 15 (average 26 in genera); fleshy pedestal of pectorals well developed.

Key to the Japanese genera of Protosalanginae

a[1]. Palate toothed, or not; tongue toothed, or not.

b[1]. Teeth on each side of palate in two series; tongue toothed; dorsal in advance of anal, or not. .... **Protosalanx**

b[2]. Teeth on each side of palate in one series; tongue not toothed; dorsal partly above anal. .... **Salangichthys**

a[2]. Palate not toothed; tongue not toothed; teeth minute. .... **Neosalanx**

Genus Salangichthys BLEEKER, 1860.

Salangichthys BLEEKER, 1860, Act. Soc. Indo-Neder., vol. 8, p. 101. – WAKIYA et TAKAHASHI, 1937, Journ. Coll. Agr. Tokyô Imv. Univ., vol. 14, no. 4, p. 276.

Characters: Teeth in jaws small, subequal, palate with one series of teeth on each side of it; tongue toothless. Dorsal partly above anal in male, somewhat or scarcely above it in female. Pectoral rays 14 to 27.

28. Salangichthys microdon BLEEKER.

White-fish, Ice-fish. "Shirauwo"

(PL. XVII, figs. 1–9. PL. XVIII, 1–15; Text-figs. 57, a–d)

Salangichthys microdon BLEEKER, 1860, Act. Soc. Sci. Indo-Neder., 8, Japan, 6, p. 101. – REGAN, 1908, Ann. Mag. Nat. Hist., (8), vol. 2, no. 11, p. 445. – WAKIYA et TAKAHASHI, 1913, Zool. Mag. Tokyô, vol. 25, pt. 301, p. 552, pl. 13, figs. a, A_1, A_2. – WAKIYA et TAKAHASHI, 1937, Jour. Coll. Agr. Tokyô Imp. Univ., vol. 14, no. 4, pp. 276-280, pl. 16, figs. 1-2; pl. 20, figs. 24-25; pl. 21, figs. b_1, b_2, c_1, c_2, d, e, f. – OKADA et MATSUBARA, 1948, Nihon no Tansuigyorui, p. 143, fig. 61.

Salanx microdon GÜNTHER, 1866, Cat. Fish. Brit. Mus., vol. 6, p. 206. – KITAHARA, 1896, Zool. Mag. Tokyô, vol. 8, pt. 98, p. 462, fig. 13. – JORDAN et SNYDER, 1902, Proc. U. S. Nat. Mus., vol. 24, p. 591. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. 6, no. 4, p. 212. – BERG, 1923, Poiss. l'eaux Douc.Russ., p. 105. – SOLDATOV et LINDBERG, 1930. Bull. Pac. Sci. Inst., vol. 5, p. 16, pl. 14.

Salanx ariakensis FRANZ, 1910, Abh. Bayer. Akad., p. 6, pl. 3, fig. 6.

Salangichthys kishinouyei WAKIYA et TAKAHASHI, 1913, Zool. Mag. Tokyô, vol. 25, pt. 301, p. 552, pl. 13, figs. b, B_1, B_2.

Description: Dorsal rays 11 to 15; anal rays 14 to 20; vertebrae 60 to 62; gillrakers 17 to 20; anal scales 17 to 18.

Head in body-length 4.6 to 5.9 in male, 5.3 to 6.2 in female; depth of body 6.9 to 11.2 in male, 9.3 to 13.3 in female. Width of head in head length 2.0 to 3.0 in male, 2.0 to 3.2 in female; eye 4.5 to 7.5 in male, 3.7 to 7.5 in female; snout 2.6 to 4.0 in male, 3.0 to 3.7 in female. Eye in snout 1.2 to 2.5 in male, 1.3 to 2.5 in female.

Snout blunt, nearly equal to width of head in front of eyes, shorter than postorbital part. Premaxillary teeth 5 to 9 in number, set rather apart, a little recurved, becoming larger posteriorly; maxillary teeth numerous, 30 to 40, closely set, much smaller than premaxillary ones, becoming somewhat smaller posteriorly mandibular teeth 10 to 25, larger than maxillary ones, but rather smaller than those of premaxillaries; teeth on palate 3 to 13 in each series, nearly equal to maxillary ones in size. Origin of anal below 6th to 10th dorsal ray in male, below 3rd from last dorsal ray or scarcely behind last dorsal ray in female. Ventrals nearer to anal than to base of pectorals.

Color in fresh, translucent, except for the eyes; two rows of black dots along the ventral surface.

Egg about 0.7 mm. in diameter. External egg-membrane consisting of threads arranged in the form of a network; about 20 threads radiating from margin of micropyle, subdivided and anastomosed on their way to the pole opposite incropyle, so as to form a network that covers nearly the whole surface of the egg, and then terminating at some distance from pole, where most of them unite singly with neighbouring ones or many of them unite and form loops.

Distribution: Pacific coast of Honshû, Japan (Miyagi Prefecture to Okayama Prefecture); Japan Sea coasts of Saghalien; Hokkaidô; Honshû (from Akita Prefecture to Shimane Prefecture); Japan Sea coast of Asiatic Continent (from Vladivostok to Fusan, Korea). Miyagi Prefecture; Ibaragi Prefecture; Mie Prefecture; Okayama Prefecture; Kumamoto Prefecture; Shimane Prefecture; Ishikawa Prefecture; Akita Prefecture; Hokkaidô (WAKIYA & TAKAHASHI); Yeddo, – Tôkyo (BLEEKER); Matsushima Bay (JORDAN & THOMPSON).

Remarks: WAKIYA and TAKAHASHI[1)] mentioned that *Salangichthys kishinouyei* is considered to be a much deviated form and took it under the synonym of the present species. They also remarked a specimen of *Salangichthys* from Ishinomaki, Miyagi-Prefecture, described by FRANZ as a male of *Salanx ariakensis* KISHINOUYE and proved as a male of *S. microdon*, by his description and figure clearly show.

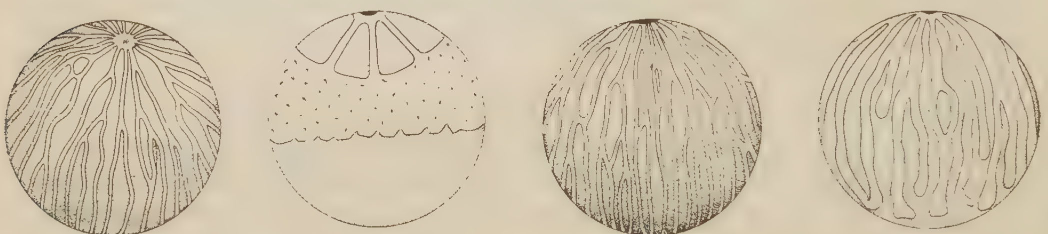
In Japan, many transparent little ice fishes are found in the spring in the bays of northern Honshû, probably ascending the streams to spawn. Most of the fish ascends the streams in summer and all individuals die in the autumn after the deposition of eggs.

JORDAN and SNYDER[2)] described that the specimens about 100 mm. long are apparently mature, having large eggs in the ovaries.

Habits and development: The breeding season occurs from the beginning to the end of May in Hokkaidô and from the middle of March to the middle of April in To-

1) WAKIYA et TAKAHASHI, 1937, Journ. Coll. Agr. Tôkyô Imp. Univ., vol. 14, no. 4, p. 280.
2) JORDAN et SNYDER, 1902, Proc., U. S. Nat. Mus., vol. 24, no. 1265, p. 592.

kyô and from the beginning of March to early in April. In that season, the one aged, mature fish ascend from the sea into muddy bottom rivers. They select a suitable spawning ground around the river mouth of 2–3 m. depth where many water plants exist. The female deposits eggs on the weeds several times. The number of eggs measured 0.8 mm. in diameter is 2,000 in one individual. A part of the outer egg membrane is modified into about 20 slender filaments radiating from the margin of blastpore, which are dichotomously divided and connected each other to make a network over the entire surface of the egg. The egg hatches out in 23–27 days under the water temperature of 8.6°C. On 29th of March 1958, the author and K. Mori had a chance to make an artificial fertilization of the present species and succeeded in the aquarium to keep the larvae during the period extending from March 29 to April 23. After 1.5 hours, the cleavage shows the morula stage. In this stage the cells covering mostly a third of the yolk are divided horizontally and vertically (fig. 5). After 18 hours, the process is reached to the blastula stage, forming a lenticular cup over the yolk (fig. 6). After 24 hours, the division shows the gastrula stage, occuppying about a half of the yolk (fig. 7). After 48 hours, the blastderm covers a sixth of the yolk, and the embryonic shield appears clearly defined. Kupfer's vesicle is seen at this stage (fig. 10). After 80 hours, the

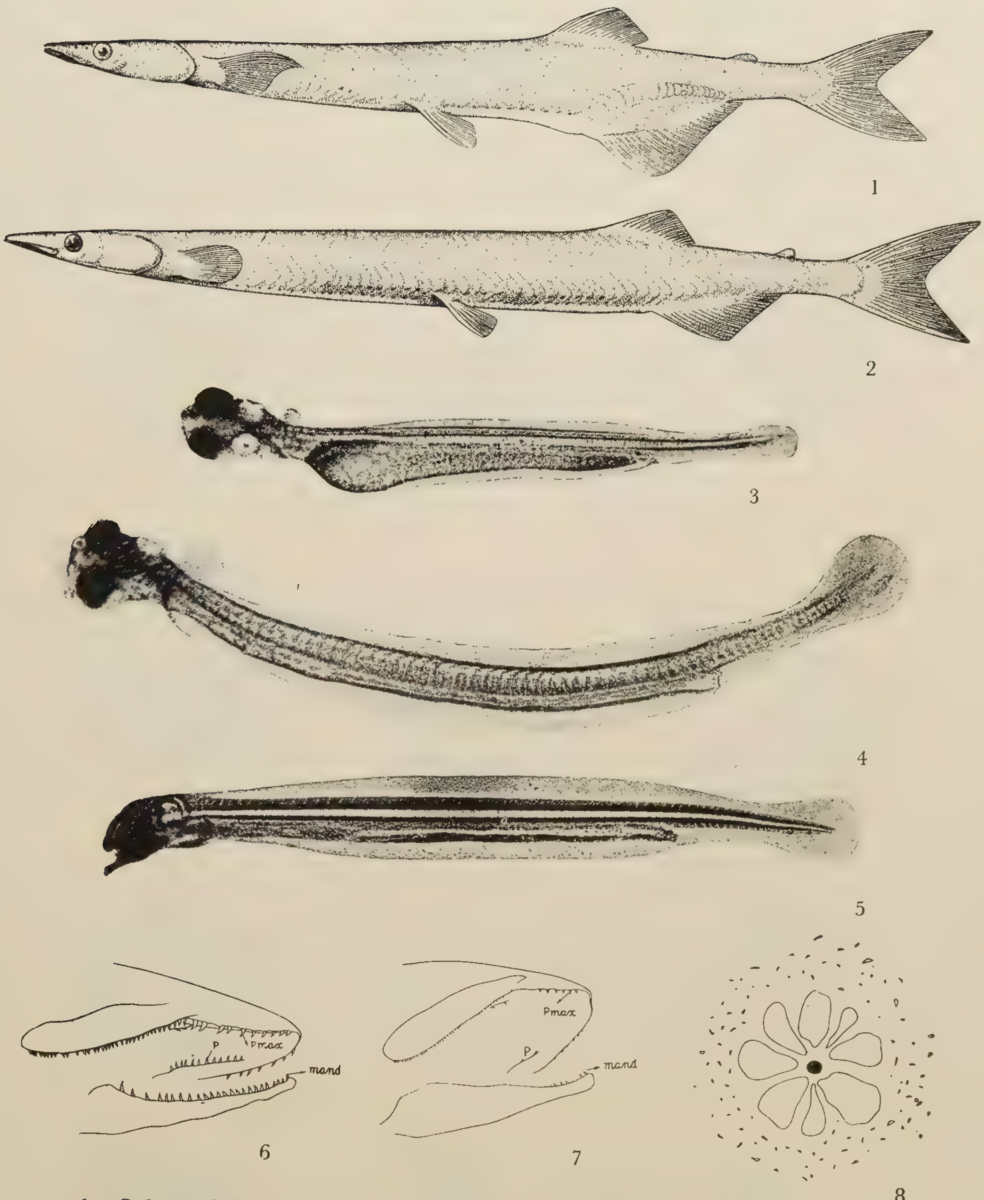


Text-fig. 57. Outer features of egg membrane of Japanese species of Salangidae. after Wakiya et Takahashi

a. *Salanx ariakensis* b. *Salangichthys microdon*
c. *Salangichthys ishikawae* d. *Salangichthys kishinouyei*

stage is characterized by the appearance of the statocyst and myotome. 31 myotomes and melanophores on the eye are fairly seen respectively (fig. 11). After 100 hours, the embryo is more elongated and coiled. It circles one and a sixth times arround the yolk (figs. 12, 13). After 284 hours, the yolk is mostly absorbed and the embryo surrounds circularly two or three times in the egg. The brain is clearly recognized. The heart contracts rhythmically on the yolk, but the blood corpuscles are not seen (fig. 14). After 312 hours, the eye becomes black by the aggregation of the numerous melanophores. The brain increases in the size, and the pectoral fin buds are seen indistinctly. In this stage the embryo moves actively at the intervals of two or three minutes (fig. 15). 336 hours (14 days) after the fertilization, the embryo breaks the egg membrane and hatches out from the tail.

Larval stage: Just immediately after the hatching, the larva measured 5.1 mm. in



1. ***Salangichthys microdon*** BLEEKER. ♂
2. ***Salangichthys microdon*** BLEEKER. ♀
3. Larva of ***Salangichthys microdon*** BLEEKER, just hatching out. ×13.
4. Larva 72 hours after hatching, depositing melanophore along intestine. ×13.
5. Post-larval stage, absorption of the yolk, 88 hours after hatching. ×13.
6. Mouth part of ***Salangichthys microdon*** BLEEKER, after WAKIYA.
7. Mouth part of ***Salangichthys ishikawae*** WAKIYA, after WAKIYA.
8. A part of external egg-membrane at the pole with micropyle of ***Salangichthys microdon*** BLEEKER, after WAKIYA.



PLATE XVIII

Development of ***Salangichthys microdon*** BLEEKER.

1. Unfertilized egg. ×35.
2. Egg, immediately after fertilization. ×35.
3. Egg with blastdisc. (1.5 hours after fertilization). ×35.
4. Two cell stage (3 hours after fertilization). ×35.
5. Morula stage (10 hours after fertilization). ×35.
6. Blastula stage (18 hours after fertilization). ×35.
7. Gastrula stage (24 hours after fertilization). ×35.
8. Early embyonic stage. ×35.
9. Further advaced embryonic stage. ×35.
10. Embryonic stage (70 hours after fertilization). ×35.
11. Formation of statocyt and myotomes. (80 hours after fertilization). ×35.
12. Embryo 100 hours after fertilization. ×35.
13. ditto.
14. Appearance of brain, (284 hours after fertilization). ×35.
15. Formation of pectoral fin buds, (312 hours after fertilization). ×35.



total length, 3.9 mm. in head and trunk region and 0.2 mm. in diameter of eye. The petcoral fin situates between the statocyst and the second myotome. The anus opens at four fifths from the tip of the snout. The larval fin membrane is originated on the dorsal edge at the occipital region, on the ventral edge inserted under the origin of the pectoral, and two membranes are confluented around the tail. The yolk sac, elongated and fusiform shaped, is not absorbed and situated in the most part of the belly region. The melanophores are more abundant in the eye, in the ventral surface of the yolk sac, and a few are found along the larval fin membrane. The larva actively swims on the surface of the water (fig. 16). 72 hours after the hatching, the larva 6.2 mm. in total length, 4.8 mm. in head and trunk region. The body is more elongated, its length about one and a fifth times of the preceding stage, and the yolk almost absorbed. In accordance with the absorption of the yolk, the melanophores may be observed along the intestine (fig. 17). 288 hours after the hatching, the larva growing up 7.7 mm. in total length, 5.8 mm. in head and trunk region, absorbs the yolk entirely, and swims near the bottom of the aquarium and rests for a few seconds there (fig. 18).

This fish is usually swimming below in the depth of 4 m. and takes small pelagic crustaceans for his food. The landlocked form always takes *Neomysis isaza*, *Leptodora* sp., *Daphnia* sp. and *Copepoda* in Kasumigaura, Ibaraki Prefecture.

Distribution: The present species are widely distributed from the south of Karafuto to Kyushû. On the Pacific coast, they are absent in the area from Miyagi Prefecture to Okayama Prefecture. In Kyushû, they are distributed in the western part except Kagoshima and Miyazaki Prefectures.

29. Salangichthys ishikawae WAKIYA et TAKAHASHI.

"Ishikawa Shirauwo"

(Text-figs. 58, a–b)

Salanx ariakensis FRANZ 1910, Abh. Bayer. Akad., p. 6, pl. 3, fig. 7.

Salangichthys ishikawae WAKIYA et TAKAHASHI, 1913, Zool. Mag. Tokyô, vol. 25, pt. 301, p. 552, pl. 13, figs. C_1, C_2, C_3. – WAKIYA et TAKAHASHI, 1937, Journ. Coll. Agr. Tokyô Imp. Univ., vol. 14, no. 4, pl. 16, figs. 3-4; pl. 20, fig. 26, pl. 21, figs. g_1, g_2. – UI 1932, Kishû Gyofu, pp. 65-66.

The original description is as follows:

Salanx ariakensis KISHINOUYE*

Tab. III, fig. (Männchen), fig. 7 (Weibchen), text-fig.

I. Brusfl-des Männchen, 2 des Weibchen.

Das Zählen der Flossen strabler ist bei der Salangiden beine leichte Aufgabe. Nitht nur die Zartheit und Kleinhert der Objekte bereitet Schwierigkeiten. Die Dorsale ist nach meinen Beobachtungen stets so gebaut, dass die Länge der Strahlen von vorm nach hinten ständig abnimmt, ober als ersten strahl sicht man stets einen besonders kurzen, ungegliederten. Entsprechend ist die Anale

*FRANZ, 1910, Abh. Bayer. Akad., supp. bd. 4, pp. 6-8, pl. 3, fig. 7.

gebaut, doch sieht man vor dem ersten, ungegliederten strahl obt no (einen oder zwei nach kürzere, die jedoch obt fehlen und auch manchmal, weil fast ganz in der Haut steckend, der Beobachtung entzehen mözen, Ich Zähle diese kurzen Strahlen nicht mit. Endlich ist der letzte Strahl der Anale stets ein Doppelstrahl; zweistrahlen entspringen aus geweinsamen Warzel. Ich zähle ihm nur als einem. KISHINOUYE (vgl. JORDAN and SNYDER, Proc. U. S. Nat. Mus., vol. XXIV, p. 592) befolgte wohl andere Prinzien. Wenn man dies annimt, wird man meine Angahen mit den seinigen vereingen können. Beider Pektoralen suid die letzten Strahlen wegen ihrer Zartheitschmer zugählen. Auch hier may K. in Anderes Vorgehen als ich geräbt haben.

Ich fuide: Kopf 5½ bis 6½ in der Länge ohne kaudale, Breite des Kopfes 1¾ mal seine Höhe. Auge 7 in Kopflänge. Interorbitalraum 3⅓. Dorsale 12 (KISHINOUYE: 13), Anale 24 bis 26 (K : 26). Pektorale 16-18 (K. : 10:)

Zähne winzig klein, etwa von gleichen Grösse. Zunge unbezahnt. Ursprung der Ventralen stets ein weing vor den Körpermitte. Dorsale beginnt über den mitte der Analen. Fettflosse über dem Ende der Analen.

Pigmentierung: Wie schon KISHINOUYE angibt, eine Reide schwarzer Chromatophoren aus Bauche



Text-figs. 58. a. ***Salangichthys ishikawae*** WAKIYA et TAKAHASHI. ♀ ×1. 5
b. ***Salangichthys ishikawae*** WAKIYA et TAKAHASHI. ♂ ×1. 5

neben der medianlinie, die Flackenreibe beginnt nahe der Medianen, in der Nähe des lersprungs der Brust-flossen, geht durch die Warzel der Bauchfloose und konvergiert mit ihrer Partnerin zum After Eine Reiche von Flecken hinter dem After in den medianen, die Anale durchsetzend und bis zur Kaudalen Seichend. Je eine keine parallel den Operkularrende. Wenig Pigment auf der Schnauze und dem Unterkiefer. Winzige Chromatophoren auf der Pektoralen (entlanz dem ersten Strahl), auf der Dorsalen (in den Strahlen wurzeln) und auf der Kaudalen (zerstreut). Bei grösseren Exemplaren wenig. Pigment auf der Schnauze.

Die so beschreibenen Exemplare sind sämtlich Männchen, als solche erkennbar an einem aus 18 schuppenartigen Plasten bestchenden Organ (Haftscheibe ?) jederseiths längs der Wurzel der Afterflosse, sowie daran, das die Basis des Aufangsseites diesen Flosse ziemlich stark hervorsteht (Taf. III, Fig. 6 – Textfig. 2).

Länge 6, 5 bis 10, 2cm.

Nichts anderes als die zugeherigen Weibchen werden die folgenden sein (Taf. III, Fig. 7).

Pectoral gerundet, klein, fast 2 in Kopf. ohne Pigmentierung (Textfig. 2).

Länge etwa wie bei dem Mänchen. Meist, wenn micht durchgehends, geschlechtsreif, Leib prall mit Eingefüllt. Diese Tasche ist nicht nur deshalb bemerkenswert, weil die Arten der Gattung offenbar geschlechtsreif gewordene Larvenstadien sind sondern auch noch aus einem anderen Grunde.

Nach dem im vorliegenden Material zu urteilen, zerfällt dieses in zwei Jahr-gänge, deren einer etwa 7 cm, der andere etwa 10 cm Länge hat. Schon der Jüngere Jahrgang ist also geschlechtsreif. Dagegen sagen JORDAN und SNYDER (l c.) von *Salanx microdon* BL.

"It is reported in Japan that the fish is animal, ascending the streams in summer, as all individuals dying in the autumn after the deposition of the eggs. This alleged fact needs verification."

Viele Exemplare-Weibchen bedeutend zahlreiches als Männchen-von Watancha und Ihinomaki, wo si zum Laiden au die Küste kanen (Stept. 1904, durch Herrn WAKIYA); coll. DOFLEIN.

Description: Dorsal rays 14 to 16; anal rays 22 to 27; pectoral rays 20 to 27; vertebrae 59; gill-rakers 17; anal scales 25.

Head in body length 5.4 to 6.8 in male, 5.7 to 6.2 in female; depth of body 6.4 to 7.2 in male, 9.9 to 11.8 in female; eye 5.0 to 5.5 in male, 4.8 to 5.3 in female; snout 3.2 to 4.0 in male, 3.2 to 4.5 in female. Eye in snout 1.3 to 1.5 in male, 1.5 in female.

Snout blunt, shorter than width of head in front of eyes, and postorbital portion, teeth in jaws smaller than those of *Salangichthys microdon*; premaxillary teeth 5 to 8, nearly equal in size to those on maxillaries which are fine, as numerous as 45, and closely set. Mandibular teeth 7 or 8, present only on anterior part; teeth on palate 2 or 3 in each series, nearly equal in size to premaxillary ones.

Origin of anal below 3rd to 5th dorsal ray in male, and below 9th to 10th in female. Ventrals nearer to anal than to base of pectorals.

Egg rather larger than that of *S. microdon*, its diameter being 0.95 mm. The structure of the external egg-membrane, which is quite different from all others, consists of a membrane covering the hemisphere of egg with micropyle in its center. Around the micropyle are eight large perforated holes of oval form, arranged like the petals of a flower, the rest of the membrane is also perforated with a larger number of small pores, while the free margin of the membrane is more or less irregularly perrated.

Type locality: Ishinomaki (WAKIYA said that is mistake for Wadanoha).

Distribution: Pacific coast of Honshû, Japan. Miyagi Prefecture; Ibaraki Prefecture; Shizuoka Prefecture; Wakayama Prefecture (WAKIYA & TAKAHASHI); River Shingu, River Ôta, Wakayama Prefecture (UI).

Remarks: The present species likes to live in more salty water than the common species *Salangichthys microdon* does. It spawns during April and May. The diameter of an egg is 0.95 mm. The outer egg membrane covers partly over the upper half of an egg. Eight large concave areas are arranged in shape of a flower around the blast pore and many other small areas are scattered. The lower margin of the outer egg membrane is roughly crenated.

Subfamily Salanginae

Characters: Premaxillaries abnormal, forming an anterior acute triangular expansion; maxillaries not reaching eyes, dentaries with large toothed bony process near symphysis; head very strongly depressed; lower jaw not projecting, but ending in distinct presymphysial appendage; premaxillary teeth enlarged, strongly recurved; max-

illary teeth rather less numerous (average 12); teeth on each side of palate in one series; symphysial canines near symphysis of lower jaw, perforating roof of mouth behind premaxillary expansion; pectoral rays about 10; fleshy pedestal of pectoral more or less developed.

Genus **Salanx** CUVIER, 1817.

Salanx CUVIER, 1817, Rengne Animal, Ist ed., II, p. 185.
Parasalanx REGAN, 1908, Ann. Mag. Nat. Hist., 8, vol. 2, p. 445.

Characters: Lower jaw ending in distinct fleshy presymphysial appendage with two series of small teeth and pair of presymphysial bones, tongue not toothed. Dorsal wholly or partly above anal.

One species *S. ariakensis* KISHINOUYE is found in Kyushû, Japan.

30. **Salanx ariakensis** KISHINOUYE.

"Ariake Shirauwo"

(Text-figs. 59.–60, a–b)

Salanx ariakensis KISHINOUYE, 1901, Zool. Mag. Tokyô, vol. 13, no. 157, pp. 359–360. – JORDAN et SNYDER, 1902, Proc. U. S. Nat. Mus., vol. 24, p. 592. – FRANZ, 1910, Abh. Bayer. Akad., supp. 13D. 4, pp. 6–8, pl. 3, fig. 7. – WAKIYA et TAKAHASHI, 1937, Jour. Coll. Agric. Tokyô Imp. Univ., vol. 14, no. 4, pp. 287–289, pl. 19, figs. 19–19; pl. 20, figs. 30–34; pl. 21, figs. Y_1, Y_2.
Parasalanx longinalis REGAN, 1908, Ann. Mag. Nat. Hist., 8, vol. 2, p. 446.
Parasalanx ariakensis WAKIYA et TAKAHASHI, 1913, Zool. Mag. Tokyô, vol. 25, no. 301, p. 554, pl. 13, figs. e_1, e_2, E_1, E_2.
Salanx curvieri WAKIYA et TAKAHASHI, 1913, Zool. Mag. Tokyô, vol. 25, no. 301, p. 555, pl. 13, figs. f^1, f^2.

The original description* is as follows:

Salanx ariakensis KISHINOUYE M.S.

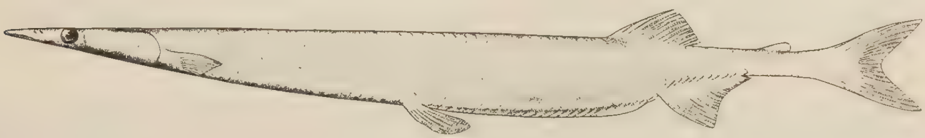
B. 3, D. 13, A. 26, P. 10, V. 7.

Length of the head 5½ times contained in the total; head nearly twice as broad as high; the diameter of the eye is about one-seventh of the length of the head. Teeth subequal. Tongue toothless. Root of the ventral fin in the middle of the total length. Dorsal fin opposite to the anal. Adipose fin originates from the base of the anal. Body scaleless and nearly colorless, except a few black spots in two rows along the ventral median line and the caudal fin, which is light brown.

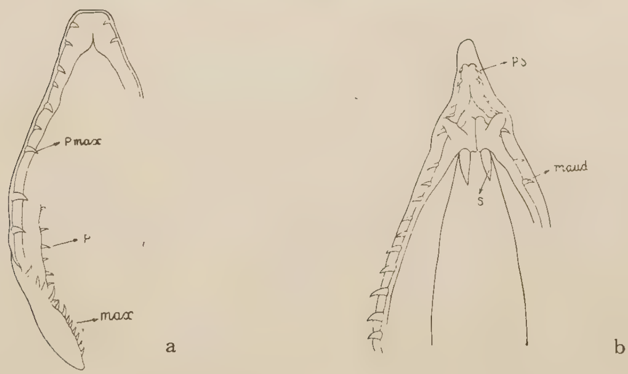
This description is based upon two specimens about 16 cm. in length. They were collected from a weir in the Ariake Sea (Kiushiu) by Mr. KAMESABURO TOYAMA, on July 19, 1901. I can not tell the the sex of these specimens, as the sexual gland is not yet ripe (KISHINOUYE).

Description: Dorsal rays 11 to 13; anal rays 27 to 32; pectoral rays 9 to 10; vertebrae 72 to 75; gill-rakers 8 to 10; anal scales 20.

Head in body length 4.8 to 5.7 in male, 4.8 to 5.3 in female; depth of body 10.2 to 12.5 in male, 13.7 to 15.8 in female; width of head in head length 2.6 to 3.3 in male, 2.9 to 3.4 in female; snout 2.4 to 2.8 in male, 2.5 to 2.6 in female; eye 6.7 to 10.0 in male, 8.3 to 10.0 in female. Eye in snout 2.5 to 3.8 in male, 3.3 to 4.4 in female.



Text-fig. 59. ***Salanx ariakensis*** KISHINOUYE. ♀ × 8/5



Text-fig. 60. a–b. Upper and lower jaws of ***Salanx ariakensis*** KISHINOUYE, after WAKIYA.

Snout pointed, longer than width of head in front of eyes, being 2.5 to 5.5 mm. shorter than postorbital part. Premaxillary teeth comparatively large 7 to 9, set rather apart, becoming larger posteriorly; maxillary teeth much smaller than premaxilly ones, about 12, becoming somewhat smaller posteriorly; mandibular teeth about 10, equal in size to premaxillary ones, becoming larger posteriorly; palatal teeth 6 to 10, nearly equal in size to maxillary ones; teeth on presymphysial appendage in two series, about 4 in each rather smaller than those of palate.

Origin of anal below 3rd of 4th dorsal ray in male and below 5th to 7th ray in female. Ventrals nearly equidistant from pectorals and anal.

Egg rather small, 0.75 mm. in diameter. External egg-membrane consisting of fine threads arranged in network, about 13 radiating from margin of micropyle, forming network which covers nearly whole surface of egg, leaving around latter pole narrow area containing many scattered fragments of threads.

Distribution: Ariake Bay, Kyushû, Japan; Korea, the coast of Yellow Sea and of the Southern part of the Japan Sea side; Ariake Bay, Kyûshû, Japan; Ôryokkô R. Yalu; River Daidôkô, Tadon; Kaishû; Fusan and Hôkô, Korea; (WAKIYA & TAKAHASHI).

31. **Salanx cuvieri** Cuvier et Valenciennes.

Salanx cuvieri Cuvier et Valenciennes, 1849, Hist. Nat. Poiss., vol. 22. p. 360. – Fang, 1934, Sinensia, vol. 4, no. 9, p. 256; – Fang, 1934, Sinensia, vol. 5, nos. 5–6, p. 507. – Wakiya et Takahashi, 1937, Jour. Coll. Agr. Tokyô Imo. Univ., vol. 14, np. 4, p. 287.

The original description is as follows:

Le **Salanx** de **Cuvier** (**Salanx Cuvieri**, nob.*)

Ce poisson a la tête singulierement aplatie depuis la nuque jusqúà l'extrémite du museum. Le trone parait plus rond. Le queue est comprimáe. La longeur de la tête. mesurèe comme á l'ordinaire depouis le bout du nurseau jusquán bard de l'opercule, est cing fois dans la longeur tatale. Lanuque ne dépresse guerè le bard du préopercule. Toute cette partie du crâne jusquaux intermaxillares farme une sorte de grand parallelogramma rectangulaire, dont la longueur est au moine triple de la largeur. Il nèst pas difficile de reconnâitre un ce crâne aplati que les frontans antérieurs sont trés-grands et un peu peu échenerés en avant. Les frontanx principaux le sont plus profondénent. L'oeil est tout a fait latéral et eur le miliendde la longuer de la tête. Je ne puis presque rien dire des eous-orbitaires, tant ile sont mincee; ils me parassent d'ailleurs fort petits. Le diametre de l'orbite est contenu sept bois dans la longueur de la tête. Le musan est trés-aplati, très-point; il est formé en haut, par les deux intermaxillaires, dont l'extremite est élargie en une petite palette triangulaire reuniè à celle de l'os opposé, par une suture droite et longitudinale. Il ny a pas de branche montante. Je vois deux petits réguliers au bord posterieur de seite enture dansl' echancrure des deux frontaux. La longueur de ces intermaxillaires est le tiers de la longuem de la tête.

Derniere eus sont articulis deux trèspetits maxillaires, qui descendent verticalement et ferment l'angle de la commissure. Les intermaxillaries n'ont aucune mobilite de sorte que la bouche ne soure que par le mouvement de bascule de la mâchaire est excessivement pointre, son angle est à peu près au milieu de l'oeil. Les deux branches ne se touchent pas en dessous; Iles laissent un isthme assez large. La preopercule se montre sous la tête comme une palette longue et mince, qui fait suit aux branches de la mâchoire inferieure. Il n'a presque pas de bord montant. Cette longuette se trouve l'largie pur uns interopercule, qui à peu paris la meme forme; mais qui est cependant moine long. L'opercule est comme une petite e'caille arroundie, et pliäe en gouttiere. Son sous opercule est triangulaire et forme avec selui de côté opposi une espêce d' ogivê assez pointru pris de la fente branchiale. Quoique les branches de la mâchoire inferieme ne se touchent pas et quélle laissent sous la gorge un isthme assez sessible, ou voir les deux opercules se toucher audelà et andevant de l'ogus dont je viens de parler. C'est à cet endroit que l'on compte les quatre rayons larges, minces et argués de la membrane branchiostége. Les ouie sont d'ailleurs trésfendue et les orceaux des branchies assez grands. Les dents de ce poisson sont dássez farts crochets sur les mâchoires. Il y en a huir hint ou neuf sur les maxillaires. La machoire inferieure en porte d'abord trois petites; puis viennent deux crochets assez longs; ensuite cing ou six petites dentes dente, lesquelles sont suivies d'um certain nombre d'autres un peu-plus grosses. Toutes ces dents sont sur un seul rang. Il y en a une rangée de tris-petites sur les palatins, qui sont écartés l'um de l'autre, et couchés le long de l'intermaxillaire. Je nén vois aucune sur le vomer, et autant que jen puis Juger sur cet exemplaire desséche, la lange ne parait lisse. La ceinture humerale se montre derriese, la unque par une série de petites piecès écailleuses, disposè an replié, pour suivre le contour de la fente branchiale. Les surscapulaires sont beaucoup plus larges et plus grande que les scapulaires. Les pectorales sont attaches tout à fair en dessous du corps; elles me paraissent assez petites. Les ventrales sont reculées à peu prés vers le milieu du corpus; la dorsale, assez semblable à lánale, mais beacoup plus corte, correspond à la partie antérieure de cette nageoire; celle-cicet étendue sur la queque, beaucoup en delà la premine. C'est la positions de cette dorsale quiavat

*Kishinouye, 1901, Zool. Mag. Tokyô, vol. 13, no. 157. pp. 359–360.
*Cuvier et Valenciennes, 1849, Hist. Nat. Poiss., vol. 22, pp. 360–363.

sans donte dooné l'idés à M. Cuvier de placer les Salaux dant la famille der Brochets. Mais il exrete sur le dos de la queue, a la hanteur des dermers rayons de l'anale, une trés-petites adipeuse. Ce caractère vient evidemment se joindre à la forme des machoires qui jai décrites, et prouve que le poisson appartient aux Salmonoide La caudale est fourchue; elle a un nombre assez considerable depetits rayons sur les deux côtes de la queue.

B. 4; D. 1P-0; A. 28; C. 40; pp. 8; v. 7.

Ce poisson ne moutre aucum vestige d'écailles; il me parait avoir été tout à fart nu. La couleur est brune. L'exemplaire unique, un peu dessiché ét en assez mauvai état qui existe dans la collection du Muséum natural, est long de quatre pouces et demi. Nous en ignorons la patrie.

Description: Body moderately compressed, deepest at origin of dorsal. Upper profile of preventral part somewhat rounded. Head strongly depressed; upper and lower surfaces broad and flat. Mouth terminal and large; maxillary not reaching to front margin of eye, $2\,^1/_{4-3}$ in head. Jaws produced and equal in front. One row of teeth in jaws, same as palatines; those teeth are all fine, conical and curved inwards; front edge of lower jaw with large two teeth. No teeth on tongue. Snout flat and long. Eye slightly anterior; center of eye a little nearer snout tip than to end of head. Interorbital space broad and flat. Postorbital part of head longer than snout.

Gill-opening not reaching to hinder margin of eye; gill-membranes free from isthmus. Origin of dorsal about midway between origin of ventral and caudal base, in advanced of anal origin; dorsal ray $2\,^1/_2$–$2\,^2/_3$ in head; when depressed, tips not reaching to end of anal base; length of base slightly shorter than longest dorsal ray. Pectoral $1\,^1/_2$–2 in head, rather long. Ventral inserted between tip of snout and caudal base (but in young nearer tip of snout), about $1\,^3/_5$–$2\,^1/_5$ in head. Anal inserted a little behind of dorsal origin, fin about equals to length of dorsal ray; base a little shorter than head. Caudal peduncle well compressed, slender and rather long, its least depth $2\,^3/_5$–3 in its length; its length about $1\,^5/_7$–2 in head. Adipose dorsal short, its origin about midway between end of dorsal base and caudal base, or nearer to latter. Caudal fin forked well. Color in fresh, translucent generally two rows of small longitudinal dotts on belly. Caudal tip slightly shaty. No scales present on the body, except base of anal, where a row of large tiled scales present.

Genus Neosalanx Wakiya et Takahashi, 1957.

Characters: Teeth in jaws minute, subequal and very few in number on premaxillaries and mandible. Palate and tongue toothless. Dorsal partly above anal or in advance of it. Pectoral rays 22 to 35.

It is very noteworthy that the average length of body is 90mm. in this genus, and the general shape of body and the relative position of the dorsal and the anal are the same as those of *Protosalanx*. So, when it is supposed that the dentition of *Protosalanx* does not differentiate in the young stage, immature specimens of this genus may be mistaken for the young of *Protosalanx*. No species of the genus described under the proper generic name.

32. Neosalanx reganius WAKIYA et TAKAHASHI.
"Regan Shirauwo"
(Text-figs. 61, a–b)

Neosalanx reganius WAKIYA et TAKAHASHI, 1937, Jour. Coll, Agric. Tokyô Imp. Univ. xiv, 4, pp. 283-284, pl. xiiv, figs. 7-8. – AOYAGI, 1957, Gen. Notes Fresh. Fish. Japan. Archip., pp. 63–64.



Text-fig. 61. a. ***Neosalanx reganius*** WAKIYA et TAKAHASHI. (♀) ×1.2
b. ***Neosalanx reganius*** WAKIYA et TAKAHASHI. (♂) ×1.2

The original description* is as follows:

Neosalanx reganius WAKIYA et TAKAHASHI

Dorsal rays 13 (13 to 14); anal rays 25 (23 to 26), pectoral rays 22 (22 to 26); vertebrae 52 to 56, averaging 53. 75; gill-rakers 15; anals cales 17 (16 to 17).

Head in body length 6.1 (5.9 to 6.6 in male, 6.1 to 7.6 in female); depth of body 6.8 (6.8 to 8.8 in male, 8.5 to 10.6 in female). Width of head in head length 1.5 (1.5 to 2.1 in male, 1.6 to 2.1 in female); eye 4.5 (4.0 to 4.8 in male, 3.5 to 4.5 in female); snout 3.5 (3.2 to 4.0 in male, 3.2 to 4.3 in female). Eye in snout 1.3 (1.0 to 1.3 in male and female).

Snout blunt when viewed from above, shorter than either width of head in front of eye or postorbital portion. Maxillary teeth minute, about 35 in number, closely set, permaxillary teeth 5; mandibular teeth 7, present only on front end of jaw, equal in size to those of maxillaries, smaller than those of premaxillaries.

Origin of anal just behind dorsal (occasionally below last ray) in male and always a little behind it in female. Ventrals equidistant from anal and pectorals in male (occasionally about 0.5 mm. either farther from or nearer to anal than to base of pectorals than to anal in female (rarely equidistant between those fins). Of 31 females examined, the ventrals in 6 examples were equidistant from anal and pectorals, while in remaining 25 they were 0.5 to 3.0 mm. nearer to pectorals than to anal. Ventrals much shorter than head, nearly equal to its postorbital region.

Diameter of egg 0.9 mm. External egg-membrane as in *Salangichthys microdon*. Breeding season from February to March. Maximum size 56 mm. (male) and 58 mm. (female).

*WAKIYA et TAKAHASHI, 1937, Gour. Coll. Agric. Tokyô Jmd. Univ., xiv, 4, pp. 283–284.

This description is based primarily on a male specimen measuring 54.5mm. in the length of body, from Ariake Bay, Kyûshû, Japan, and secondarily on paratypes from the same locality. The species has not been secured from any other locality.

Neosalanx reganius differs from *N. jordani* in having a larger number of vertebrae, the anal situated more posteriorly in reference to the dorsal and in the position of the ventrals relative to the pectorals and the anal in each sex, and in the size of the egg and the structure of the egg-membrane.

We have pleasure in dedicating this new species to Dr. CHARLES T. REGAN, directcr othe Natural History Depth., British Museum.

Order Cyprinida

Characters: Eventognathid fishes with the lower pharyngeals falciform, parallel with the gill arches; 2 upper pharyngeal bones; brain case produced between orbits; basis canii simple; jaws without teeth; dorsal fin present; no adipose fin; ventrals abdominal. Gill openings restricted, the gill membranes attached to the isthmus.

Suborder Cyprinina

Key, to the Japanese families of Cyprinina

a[1] No suborbital or preorbital spine; mouth terminal or inferior; barbels none, or 2, or 4; pharyngeal teeth in 1, 2, or 3 rows; air bladder divided into 2 antero-posterior parts, not enclosed in bone. .... **Cyprinidae**

a[2] A suborbital or preorbital spine present or absent; mouth inferior; barbels 6 or 8; pharyngeal teeth in a single row; air bladder enclosed in bone, its posterior part small or vestigial. .... **Cobitidae**

Family Cyprinidae

Characters: Body variously deep to elongate. Belly usually rounded, rarely compressed or serrated. Upper jaw edge formed entirely by premaxillaries. Barbels 4, 2 or absent. Gill-openings moderate, membranes joined broadly to isthmus. Gills 4, slit behind fourth. Pseudobranchiae usually present. Branchiostegals few, usually 3. Lower pharyngeal bones well-developed, scythe-shaped, nearly parallel with gill arches, each with 1 to 3 rows of teeth, 4 to 7 teeth in main row and also in the other rows if present. Bulbi olfactorii usually close to nasal sacs. The largest otolith is the lagenar. Air bladder usually large, often divided into front and hind lobes, not enclosed in bony covering and rarely absent. Stomach without appendages, formed simply as enlargement of alimentary canal. Head always naked. Body mostly scaly, seldom naked. Dorsal fin elongate or short. Ventrals abdominal. The carps or minnows comprise the most important family in the order to which they belong, and are of interestnot only in the number of divergent species and races but also in the myriads of individuals and their part in the economy of nature. They far outrank all the other families in genera, species, and also in having representatives in all the countries where these other forms occur.

Subfamily Cyprininae

Characters: No knob at symphysis of lower jaw; barbels rostral and maxillary, but one or both pairs may be absent; dorsal fin with 7 to 30 branched rays and with or without an osseous simple ray, which may be smooth or denticulated, arising before, over, or behind origin of ventrals; anal fin with 5 to 9 branched rays and with or without an osseous simple ray; lateral line running along middle of caudal peduncle.

Key to Japanese genera of Cyprininae

a^1 Base of dorsal fin short; fin ray 8–15 in number; with spines on anterior dorsal but not denticulated on posterior; anal without spine.

b^1 Body laterally compressed, higher; origin of anal fin inserted at base of dorsal, mostly lips thin and smooth. Pharyngeal teeth uniserial. Peritoneum blackish brown. Alimentary canal long. In breeding season, female with long ovipositor.

c^1 Lateral line complete.

d^1 Pharyngeal teeth smooth; with pair of barbels around mouth. .... **Acheilognathus**

d^2 Pharyngeal teeth with transverse groove on lateral side. Barbels very short or none. .... **Paracheilognathus**

c^2 Lateral line incomplete (sometimes none).

e^1 Pair of long barbel around mouth. .... **Tanakia**

e^2 Without barbel around mouth. ....

f^1 Scale somewhat large, about 32–33 in longitudinal line. Pharyngeal teeth smooth.

g^1 Unbranched fin ray of dorsal fin not spinous. .... **Rhodeus**

g^2 Unbranched fin ray of dorsal fin strongly spinous. .... **Acanthorhodeus**

f^2 Scale generally small about 55 in longitudinal line. Pharyngeal teeth with transverse groove on lateral side .... **Pseudoperilampus**

b^2 Body not so high; origin of anal fin inserted posteriorly from base of dorsal fin. Pharyngeal teeth uniserial, biserial, or triserial. Peritoneum light color. Alimentary canal short.

h^1 Pair of barbel around mouth.

i^1 Without spine on anterior dorsal fin.

j^1 Pharyngeal teeth uniserial.

k^1 Mouth terminal; both lips same in length; mouth thicker on lateral; snout compressed longitudinally and pointed at end. Anus just front of anal fin. .... **Pungtungia**

k^2 Mouth under snout.

l^1 Height of dorsal fin moderate, middle soft ray very long. Dorsal side of head rounded. Anus posteriorly from middle of anal fin and origin of ventral fin. In breeding season, female with short ovipositor. .... **Sarcocheilichthys**

l^2 Height of dorsal fin very high. In male, middle soft ray very long. Dorsal side of head flattened. Anus somewhat nearer origin of ventral fin than origin of anal fin. Heart shaped skin tubercle on just behind middle of lower jaw .... **Abbottina**

j^2 Pharyngeal teeth biserial.

m^1 Mouth terminal; lips thin, smooth; eye large. Snout short, not depressed... **Gnathopogon**

m^2 Mouth small, opening under snout; lips broad with minute papillae densely. Eye moderately small. Snout long, depressed longitudinally. Anus opens nearer the anal fin than ventral fin. .... **Pseudogobio**

i^2 Hard spine on anterior part of dorsal fin (occasionally end soft). Pharyngeal teeth triserial. Mouth mostly opens under the snout; jaws somewhat thick, but smooth. Anus opens just front of anal fin. Lateral line straight. .... **Hemibarbus**

h^2 Without barbel around mouth.

n[1] Pharyngeal teeth uniserial. Indentation on lower shoulder girdle in branchial cavity. Scale large.

o[1] Snout very obtuse, rounded at end; mouth opens under snout. Origin of dorsal fin anteriorly than origin of ventral fin. Anus nearer origin of ventral fin than origin of anal fin. .... **Biwia**

o[2] Snout long; mouth small opening at end of head; lower lip somewhat projected than upper lip. Origin of dorsal fin somewhat posteriorly than origin of ventral fin. Anus very nearer than origin of anal fin than that of ventral fin. .... **Pseudorasbora**

n[2] Pharyngeal teeth in biserial.

p[1] Scale large, arranged 32–34 in longitudinal row. Weak elevation on ventral side, just front of anus. 50-60 mm. in size. .... **Aphyocypris**

p[2] Scale small, arranged 70 more in longitudinal row.

q[1] Origin of anal fin inserted posteriorly than posterior end of base of dorsal fin. Lower branchial rays of first branchiostegals 9–12. Radii developed only on apical and lateral sides of scale. Body without patterns. .... **Tribolodon**

q[2] Origin of anal fin inserted from posterior end of base of dorsal fin. Branchio-stegals 3-6. Radii developed even on basal side. Dark brown scales scattered on body .... **Moroco**

n[3] Pharyngeal teeth triserial. Lateral line curved deeply downward.

r[1] Ventral side rounded. In male, fin rays of anal fin longer.

s[1] Mouth moderate .... **Zacco**

s[2] Mouth transverse, with deep indentation. .... **Opsariichthys**

r[2] Ventral side depressed bilaterally forming ridge margins.

t[1] Scales 30 in longitudinal row. Anal fin with 10 soft rays .... **Hemigrammocypris**

t[2] Scales 70 in longitudinal row. Anal fin with 17 soft rays. .... **Ishikauia**

a[2] Base of dorsal fin long; rays 18 or more. Big third unbranched spines of dorsal and anal fins with denticulated teeth. Pharyngeal teeth mola like.

u[1] Without barbel around mouth. Pharyngeal teeth uniserial, arranged 4–4 .... **Carassius**

u[2] With two pairs of barbel around mouth. Pharyngeal teeth triserial, arranged 1, 1, 3–3, 1, 1 .... **Cyprinus**

Genus **Acheilognathus** BLEEKER, 1860.

Acheilognathus BLEEKER, 1860, Ichth. Archipel. Indic. Prodr. II, p. 228.

Type: **Acheilognathus melanogaster**

Characters: Body more or less deep and compressed; head short; eye more or less large; snout rather short and blunt; mouth small, the maxillary not reaching the eye. Eye placed in or above the axis of the body. Barbels present or absent. Pharyngeal 5–5 in one row, smooth, with a narrow grinding surface; interorbital space rather broad. Gill membranes attached to the isthmus. Gill rakers not fused. Intestine long. Peritoneum black. Scales large, some of those on the sides imbricated, 36 to 39. Origin of dorsal about midway in the length of body without caudal, base of fin moderate, with 8 to 15 developed rays; origin of anal anterior to the vertical from the end of the dorsal base, anal branched rays 8 to 14; caudal deeply emarginate, ventrals generally inserted a little before origin of dorsal. Lateral line slightly decurved, and continuous. No scaleless keel before anal fin.

Key to Japanese species of Acheilognathus

a[1] Pharyngeal teeth in part at least plicate transversely on the lower lateral face of each tooth; barbels small or obsolete.

b[1] Barbels small.

c[1] Dorsal fin very long, of 14 or 15 developed rays; shoulder spot present, close behind opercle; depth 2.25 in length; anal rays 9 or 10; dorsal base 3.5 in body; teeth all plicate. .... **Ach. rhombea**

c[2] Dorsal fin short, of 8 to 10 developed rays.

d[1] Shoulder-spot close behind opercle; depth 2.75 in length; base of dorsal short; teeth not all plicate; scales 37; dorsal rays 9 or 10; anal rays 9 or 10. .... **Ach. tabina**

d[2] Shoulder-spot 5 or 6 scales behind opercle; dorsal base very short, 5 in length; scales 39. .... **Ach. cyanostigma**

b[2] Barbel wanting.

e Dorsal fin with 15 developed rays; opercular spot wanting; anal rays 14 or 15. .... **Ach. longipinnis**

a[2] Pharyngeal teeth all smooth; barbel present, short or long; dorsal short, of about 8 rays.

e[1] Depth great, 2.33 to 2.12 in bodylength; no lateral stripe; barbels long over half diameter of eye, and equal to snout; D. III, 8; A. II, 10 or 11. .... **Ach. limbatus**

e[2] Depth less, 3.33 to 2.77.

g[1] Barbels slightly over half diameter of eye; lateral stripe indistinct, or lacking.

h[1] Dorsal fin with 9 developed rays, Anal fin 10; barbel 1.5 in snout. .... **Ach. intermedius**

h[2] Dorsal fin 8; nal fin. 9; barbel equal to snout. .... **Ach. lanceolatus**

g[2] Barbels much less than half of eye; lateral stripe indistinct, as wide as pupil of eye. .... **Ach. moriokae**

33. Acheilognathus longipinnis REGAN.

"Biwatanago, Itasenbara"

(Text-fig. 62)

Acheilognathus longipinnis REGAN, 1905, Ann. Mag. Nat. Hist., vol. xvi, ser. 7, pp. 364–365. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, no. 4, pp. 219–220. – TANAKA, 1911, Fishes of Japan, pp. 35–36, pl. ix, fig. 27. – TANAKA, 1921, Nihongyogaku, pp. 181–182, pl. 4, fig. 18. – OKADA, 1934, Scien. Rep. Tokyo Bunrika Daigaku, sect. B, no. 28, pp. 31–35, pl. iii, fig. 2. – MIYADI, 1935, Kyotofuka no Tansuigyo, p. 24.

Acheilognathus longipinne JORDAN, TANAKA et SNYDER, 1913, Cat. Fishes of Japan, p. 64.

The original description* is as follows:

Pharyngeal teeth 5-6, sickly-shaped, the sides with transverse striae, the edges entire. Depth of body $2\text{–}2^1/_4$ in the length, length of head $4\text{–}4^1/_3$.

Snout $^1/_2$ the diameter of eye, which is $2^1/_2\text{–}2^3/_4$ in the length of head and equal to the interorbital width. Lower jaw a little shorter than the upper maxillary hardly reaching the vertical from the anterior margin of eye: no barbels. Scales 35-38 $\frac{5^1/_2\text{–}6}{8\text{–}9}$, $5^1/_2$ or 6 between lateral line and root of ventral. Dorsal II 14–15, originating at a point equidistant from tip ofsno ut and base of caudal: anterior branched rays as long as the head. Anal II 14–15. Pectoral nearly as long as the head, extending to the root of the ventral. Ventral 8-rayed, a little shorter than the pectoral extending a little beyond the origin of anal. Caudal deeply forked. Caudal peduncle longer than deep. Olivaceous

*REGAN, 1905, Ann. Mag. Nat. Hist., vol. xvi, ser. 7, pp. 364–365.

above, silvery below; lower parts of abdomen blackish; vertical fins dusky, the dorsal and caudal wlth some dark spots on the rays, the anal with a blackish edge; ventral blackish, with the outermost ray white.

Four specimens 62 to 78 mm. in total length, from the Yamasabu River, Lake Biwa.

Type: locality: Yamasabu River Nagoya.

Description: Depth 2.16 in body-length to base of caudal, D. III, 15; A. II, 14 or 15; scales in lateral line 36, in transverse series $^6/_6$; pharyngeal teeth 5–5.



Text-fig. 62. ***Acheilognathus longipinnis*** Regan. × 1

Body deep, much compressed; caudal peduncle also compressed. Head short, 4 in body-length, compressed, eye large, longer than snout, 3 in head, lateral; interorbital space rather broad, elevated, somewhat concave medianly; snout shortl 4 in head, in profile very steep anteriorly. Mouth subinferior, more oblique than usual; maxillary extending beyond anterior rim of anterior nostril, tip of the premaxillaries at, or below, the level of the lower edge of the pupil. Gill opennings large, joined to the isthmus; gill-rakers on first gill-arch very short, weak, 3 + 13 on first arch, comparatively long, and not much shorter anteriorly than posteriorly. Pharyngeal teeth 5–5, sickle-shaped, with transverse striae on sides, the narrow grinding edge not serrate, tip hooked; pseudo-branchiae well-developed.

Dorsal fin inserted midway between tip of snout and base of caudal peduncle; third and longest dorsal ray 1.1 in head; margin of fin straight or slightly rounded, its base 2.86 in body-length. Anal unbranched ray, its margin somewhat falcate, its base 3.5 in body length. Pectorals reaching base of ventrals, equal to length of caudal peduncle; ventrals inserted before dorsal, not reaching anal; a small ventral flap. Caudal forked; peduncle short, its length from last anal ray to last vertebra equal to length of head without snout, or 1.4 in head; its depth 2 in head. Scales large, cycloid. Lateral line complete, slightly decurved.

Color in formalin very pale, olivaceous above, pale below; an indistinct spot near shoulder, no lateral stripe. Dorsal fin light brown, with two black lines running longitudinally along center of fin, alternating with pale lines, margin of fins in males with a narrow margin of intense blue-black; anal similar to dorsal in shape and coloration. Pectorals and ventrals dusky, with slight pigmentation. The belly of males black from throat to anal fin, including base of pectorals, the area sharply separated from the colorless area above.

Table 33. Measurements of *Acheilognathus longipinnis* REGAN.

Collection	O. H. B. S.*		
Total length	92.0 mm.	99.0 mm.	78.0 mm.
Body length	72.0	74.0	57.0
Body length/Head	3.78	3.90	3.00
Body length/Depth	2.00	1.95	2.11
Body length/Predorsal length	1.94	1.85	1.78
Body length/Prepectoral length	4.00	4.10	3.80
Body length/Preventral length	2.12	2.18	2.11
Body length/Preanal length	1.60	1.64	1.58
Head/Snout	3·80	3.81	2.67
Head/Upper jaw	4.22	3.80	2.67
Head/Interorbital width	3.18	2.72	3.67
Head/Diameter of Eye	3.80	3.80	3.34
Head/Length of Caudal peduncle	1.27	1.36	1.13
Head/Depth of Caudal peduncle	2.12	2.24	2.14
Head/Length of Dorsal fin	0.99	0.63	0.65
Head/Length of Anal fin	1.13	0.78	0.94
Head/Height of Dorsal fin	1.58	1.00	1.50
Head/Height of Anal fin	1.36	1.18	1.30
Head/Pectoral length	1.27	1.12	1.25
Head/Ventral length	1.73	1.27	1.25
Date	20, VII, 1927		1928
Locality	Kobata-Ike, Kyôto		

* Ôtsu Hydrobiological Station attached to Faculty of Science, Kyôto University.

In the breeding season, the males of this species differ from the females in color and also in the possession of pearl organs on the anterior lateral side of snout, internasal space, anterior orbit, anterior lower margin of orbit and preopercle. The males are purple on dorso-lateral and reddish light black on ventral. The females have a light greynish ovipositer. The pearl organs appear on the top of the snout, on the internasal space and above the anterior edge of the orbit as well as on the preopercles.

In the breeding season, the males of the species differ from purple on dorso-lateral and reddish light black on ventral and female has a light greyish ovipositer.

Habits : This species is found abundantly in the plain of Gifu Prefecture and also in River Yodo not in Lake Biwa. They are phytophagus and not so active in swimming, found mostly in ditches or small ponds. Breeding season is in autumn; the eggs are ovoid, measured 1.2 -1.3 mm. × 3.3–3.6 mm. in size deposited in branchial chambers of vivalve. Hatched larva extruds in next spring from mussels into water. It has a black spot on the dorsal fin.

Distribution: Nagoya, (REGAN); Matsubara, Lake Biwa (JORDAN); Gifu Prov. Mino (TANAKA); River, Yodo Kyôtofu; Gifu Prefecture; Mie Prefecture (MIYADI); River Kiso (REGAN, JORDAN, THOMPSON, NIWA); Ôgaki (NAKAMURA); Lake Biwa (TANAKA, REGAN, MIYADI).

34. Acheilognathus rhombeus (TEMMIMCK et SCHLEGEL).
"Kanehira"
(PL. XIX, figs. 1–3)

Capoeta rhombea TEMMINCK et SCHLEGEL, 1846, Fauna Japon. Poiss., p. 205, pl. 100, fig. 6. - GÜNTHER, 1868, Cat. Fish. Brit. Mus., vol. vii, p. 229. - JORDAN et THOMPSON 1915, Mem. Carn. Mus., vol. 6, no. 4, pp. 217-219.

Acheilognathus rhombeum JORDAN et SNYDER. 1901, Proc. U. S. N. Mus., vol. xxiii, no. 1213, pp. 343. - TANAKA, 1921, Nihon Gyokaku, p. 181.

Acheilognathus smithii REGAN, 1908, Ann. Mag. Nat. Hist., vol. 1, ser. 8, pp. 150-151.

Acheilognathus rhombeus BLEEKER, 1860, Prodr. Cypr., 1, pl. 225.

Paracheilognathus rhombeus BLEEKER, 1863, Atl. Ichthyol. Cypr., p. 33.

Acheilognathus rhombeus GÜNTHER, 1868, Cat. Fish., vii, p. 279. - ISHIKAWA, 1897, Prel. Cat., p. 12. - OKADA, 1934, Sci. Rep. Tokyô Bunrika Daigaku, sect. B, no. 28, pp. 31-35, pl. iii, fig. 6.

Paracheilognathus rhombea JORDAN et FOWLER, 1903, Proc. U. S. N. Mus., vol. xxvi, p. 815. - TANAKA, 1908, Ann. Zool. Jap., vii, part 1, p. 2. - UCHIDA, 1939, Fishes of Tyôsen, pp. 154–160, pl. 12, figs. 1–3.

Acheilognathus steenackeri SAUVAGE, 1833, Bull. Soc. Philom., Paris, p. 3.

Acheilognathus rhombea MIYADI, 1935, Kyôtofuka no Tansuigyo, p. 23. - OKADA et NAKAMURA, 1948, Nihon no Tansui Gyorui, pp. 152–153, fig. 72.

The original description* is as follows:

Capoeta rhombea, Pl. C, fig. 6. Tout en se rappochant par ses formes en général de la précédente, l'espéce dont nous traiterons s'en éloigne constamment par sa tête plus longue, par ses barbillons extrêmement petits, par ses pectorales plus courtes, par sa ligne latérale moins arquée et par sa dorsale plus longue et composée d'un nombre plus considérable de rayons, par des différences dansla distribution des teintes et par plusieurs autres caracteres moins saillants.

Nous avons sous les yeux une dizaine d'individus de cette espèce, dont la longueur totale varie de trois pouces á trois pouces et trois quarts. La grosseur du corps est environ trois fois et un quart dans sa hauteur qui elle-même entre deux fois et deux tiers dans la longueur comprise entre l'extrémité du museau et l'échancrure de la caudale. La tête est quatre fois et demie dans cette longueur; le diamètre de l'aeil égale le museau, qui entre quatre fois dans la tête; l'entredeux des yeux est de moitié plus considérable que le diamètre de ces organes. Le dessus de la tête est arrondi vers les côtés, et la ligne de séparation de la tête et de la nuque forme, au milieu et vers le dos, une saillie arrondie. Le museau est comme renflé au dessus des narines, et un peu arrondi par devant. La bouche est très-étroite, presque horizontale, et la mâchoire inférieure est tant soit peu plus courte que la supérieure. Les barbillons sont extrêmement petits et trèsgrêles, de sorte qu'ils échappent facilement aux recherches. La ligne latérale est légerement arequée vers le bas. Le nombre des rangées d'écailles est comme dans l'espéce précédente. L'anus s'ouvre entre les ventrales et l'anale, au milieu de la distance comprise entre le bout du museau et l'échancrure de la caudale.

* TEMMINCK et SCHLEGEL, 1846, Faun. Japon. Poiss., p. 295, pl. 100, fig. 6.

La longueur des pectorales fait un peu plus de deux tiers de la longueur de la tête; leur extremité est éloignee de la base des ventrales a une distance égalant le quart de leur longueur. Les ventrales, aussi longues que les pectorales, atteignent á peu prés la base de l'anale, dont la hauteur par derriére n'est que d'un tiers moindre que par devant, où elle égalela longueur des ventrales; le bord inférieur de cette nageoire est tant soit peu arrondi. La caudale est profondément échancrée. La dorsale naît vis-á-vis de l'aiselle des ventrales; quoique beaucoup plus longue, elle n'est guére plus élevée que l'anale, á laquelle elle ressemble aussi par ses formes. Les rayons indivisés de ces nageoires ont, ainsi que cela a lieu dans toutes les áutres espéces japonaises, des bords lisses.et nullement dentelés. D. 3+12 ou 13; A. 2+9, 10 ou 11; V. 1+7; P. 15; C. 19.

A l'etat vivant, ce poisson est d'un blanc argenté, passant au bleuâtre sur les flancs et d'un blanc argénte, passant au bleuâtre sur les flancs et au verdâtre sur le dessus. Les nageoires sont d'un brun clair; la dorsale et l'anale sont ornées de plusieurs bandes alternes blanchâtres et brunâtres, peu apparentes et souvent incomplètes ou composèes seulemens de taches ou points rangés en lignes parallèles à la ligne de la base de ces nageoires qui sont aussi plusou moins teintes de rouge vers leur pointe antérieure. On remarque de chaque côté du poisson, au dessus de la ligne latérale, une raie bleuâtre qui se prolonge en s'amincissant et en se recourbant un peu vers le haut, jusqu'au point du commencement de la ligne latérale. Sa fin par devant est ordinairement marquée par une tache bleuâtre, et l'on voit une tache semblable et également assez mal déterminée sur la région de la cinquième ècaille de la ligne latérale. L'iris de l'aeil est d'un blanc argente, tacheté de rouge. Les individus, dont la longueur approche de quatre pouces, offrent cependant des teintes moins vives, et ils ont quelquefois le dos et les nageoires, notamment la dorsale et la caudale, parsemés de points noirâtres.

Les dents pharyngiennes de cette espèce, au nombre de cinq de chaque côté, sont comme dans les autres espèces japonaises de ce genre, très-serrées les unes contre les autres, comprimées et à pointe trèsaiguë et recourbée. Elle a l'intestin roulé en spirale, comme la Bouvière des equx d'Europe.

Nous avons fait observer plus haut que les espèces japonaises du genre Capoète offrent beaucoup d'analogie avec certains poissons du genre *Able* ou *Leuciscus*, et qu'ily a dans ces deux genres des espèces, qui, à part quelques caractères isolés, se ressemblent au point qu'elles paraissent au premier coup d'aeil plutôt appartenir à des varietés de la même espèce qu à des espèces formant des genres distincts. La *Capoeta rhombea* est du numbre de celles où cette analogie est tresfrappante en ce qu'elle semble absolument modelée sur le même type que la Bouvière d'Europe ou le *Leuciscus amarus* des méthodes. Elle se rapporte en effet à cette espèce par l'ensemble de sa physionomie, par ses formes, par ses teintes et même jusqu à la conformation du canal intestinal, quoique d'un antre côté elle offre des caractéres constants et assez tranchants, savoir la présence d'un petit barbillon à l'angle de la bouche, quelques rayons de plus à la dorsale, et une ligne latérale continue jusqu' à la base de la caudale et non pas réduite, comme dans la Bouvière, aux premières cinq écailles appartenant à la rangée qui se prolonge derrière l'angle supérieur de la fente des ouies. Cette analogie est cependant moins sensible quant on a devant les yeux de très-vieux individus de la *Capoëta rhombea.*

Descripiton: Head 41; depth 2.5 to 2.12 in body length; D., III, 12; A., II, 10; P., 14; V., 8; scales, 35 -38 in lateral line; two scales between origin of dorsal and lateral line, and 7 scales between latter and middle of belly; pharyngeal teeth, 5--5; width of head; eye, 4; interorbital space, 2.5; pectoral, 1.3; ventral 1.5.

Body deep, rhomboid, and greatly compressed. Head short, 4 in body length and compressed; snout 3.56 in head, pointed; convex above, and slightly projecting beyond the jaws; eye moderate, anterior about equal to snout; mouth small, inferior, horizontal and protractile, the maxillary not reaching as far oposteriorly as the front margin of eye; tip of premaxillaries level with lower edge of orbit; profile or snout arched at nostrils, that of occiput strongly depressed in adults; lips somewhat fleshy; a small maxillary barbel generally less than half the eye; pharyngeal teeth folded or plicate on the

lower lateral face of each in a transverse direction, not truely serrate with narrow grinding surface, and hooked over at tips; nostrils close together, nearer eye than tip of snout; interorbital space broad, elevated a little, and flattened in the middle. Gill opennings large; gill rakers short, weak, 4 + 1 on first arch, equal in length of barbel; pseudobranchiae well developed. Intestine very long, and with numerous convolutions. Peritoneum dark or blackish. Depth of caudal peduncle slightly more than half the length of head, its length 1.25 in head.

Scales large, cycloid, and some on the middle of the sides strongly imbricated; no pectoral flap; ventral flap rather short.

Dorsal inserted midway between snout and base of caudal, its base 1.12 times length of head, its height nearly equal to head; the anterior rays the highest, the base of the fin a little over 3 in body without caudal, the third rudimentary ray as long as first developed ray, thick and strong, and the margin of the fin convex; origin of anal about midway in the base of dorsal, or the space between the origin of ventral and base of last anal ray, the anterior rays the highest, the base of the fin equal to head without snout, and the margin of the fin nearly straight; caudal deeply emarginate, the lobes pointed; pectorals rather small, low, and reaching two-thirds the distance to origin of ventrals; ventrals inserted a little before the origin of dorsal and reaching almost to origin of

Table 34. Measurements of *Acheilognathus rhombeus* (T. et SCH.).

Collection	O. H. B. S.*			
Total length	85.0mm.	91.0mm.	82.0mm.	105.0mm.
Body length	69.0	73.0	69.0	85.0
Body length/Head	3.64	3.65	4.06	4.05
Body length/Depth	2.46	2.14	2.38	2.58
Body length/Predorsal length	1.87	1.83	1.82	1.89
Body length/Prepectoral length	4.07	3.65	3.64	4.25
Body length/Preventsal length	2.03	1.98	2.03	2.07
Body length/Preanal length	1.53	1.59	1.68	1.73
Head/Snout	3.16	2.86	2.84	3.00
Head/Upper jaw	3.16	3.33	2.82	3.50
Head/Interorbital width	2.71	2.96	2.43	2.63
Head/Diameter of Eye	3.80	4.00	4.00	3.50
Head/Length of Caudal peduncle	1.19	1.18	1.21	1.11
Head/Depth of Caudal peduncle	2.14	2.00	1.70	1.91
Head/Length of Dorsal fin	0.95	0.95	0.85	0.81
Head/Length of Anal fin	1.46	1.43	1.42	1.31
Head/Height of Dorsal fin	1.90	1.54	1.70	1.62
Head/Pectoral length	1.58	1.33	1.31	1.31
Head/Ventral length	1.90	1.67	1.55	1.50
Date	X, 1916			III, 1915
Locality	Yanagawa, Fukuoka Pref.			Hikone

* Ôtsu Hydrobiological Station, attached to the Faculty of Science, Kyôto University.

anal. Lateral line continuous and nearly straight along the sides to base of caudal.

Body dark brown above, especially on line of back; the scale edged with darker; below pale, washed with silvery; sides more or less brassy; a blue-black stripe as wide

as pupil arising abruptly at fourth scale from last in lateral line and extending forward to below first branched rays of dorsal; a blue-black spot just behind and above angle of opercle nearly as large as eye. Dorsal fin rays with a white spot on each, half way to tip, the membranes marked with a corresponding blue-black blotch, just behind white parts of rays; often a second row of white spots on rays distal to the others and separated by darker space, giving the appearance of two fine stripes; anal similar; caudal dark; paired fins clear; peritoneum black. Ovipositor rather short and light greyish.

Secondary sexual characters: The soft rays of male dorsal fin are somewhat longer than those of the female. The out-line of the male dorsal fin is rounded while that of the female is nearly straight. The bluish green longitudinal stripe running on the lateral side of body is broader than that of the female.

In the breeding season, the males of this species differ in several characters from the female. The body shows nuptial coloration; greenish blue on dorsal and red darker on belly. The well-developed pearl organs also appear on the snout on the upper jaw as well as on internasal space, around eye and on the preopercle. The development of pearl organs is more distinct than in most of the other species, but very variable according to the breeding season. The ovipositor greyish.

Habits: In two years, the fish mature. The breeding season around Lake Biwa, occurs from September to November, while around the River Yana, Fukuoka Prefecture occurs from June to September. The length of ovipositor during the breeding season generally reaches 25–30 mm. Eggs are deposited in the branchial chamber of *Unio douglasiae nipponensis*. Eggs are yellow, oval, covered with sticky gelatinous substance, measred 1.5–1.7 mm. x 2.6–2.8 mm. in size. They hatch out in 40 hours after fertilization, under the water temperature of 23°–24°C. The just hatching out larva is 3.3 mm. in body length and stays in the branchial chamber of *Unio douglasiae nipponesis* on the end of autumn and winter there. The larvae grow up 10 mm. long, by the next May and June, and leave the vivalve and swim into the waters.

The present species omnivorous. The breeding season in autumn, deposising elliptical eggs in branchial chambers of freshwater mussels. Youngs and immature fishes have black spots on the dorsal fin. Larva with scale-like tubercles on the entire surface of the body.

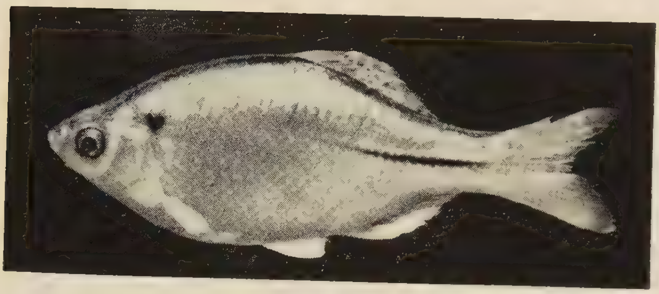
Type locality: Streams near Nagasaki.

Distribution: Nagasaki (GUNTHER); Tokyô, Lake Biwa, Yamasiro (ISHIKAWA); Lake Biwa (SAUVAGE); Lake Biwa; River Yodo; River Tikugo; Hunayado; Lake Biwa at Katata and Iba (TANAKA); Lake Biwa (JORDAN & SNYDER); River Yodo; Lake Biwa (MIYADI); Lake Biwa; Kyushû (OKADA & NAKAMURA); River (UI); Kino Lake Biwa (JORDAN & THOMPSON); River Yodo, Ôsaka; River Chikugo; River Yabe (JORDAN & FOWLER); Kumamoto, Kyushû (JORDAN & HUBBS): Nagasaki (TEMMINCK & SCHLEGEL); River Ura kami, Nagasaki city, Nagasaki Prefecture; Lake Toro, Hokkaidô; River Miomote, Murakami, Niigata Prefecture; Iwafune gun, Niigata Prefecture; River Yabe, Fuku-

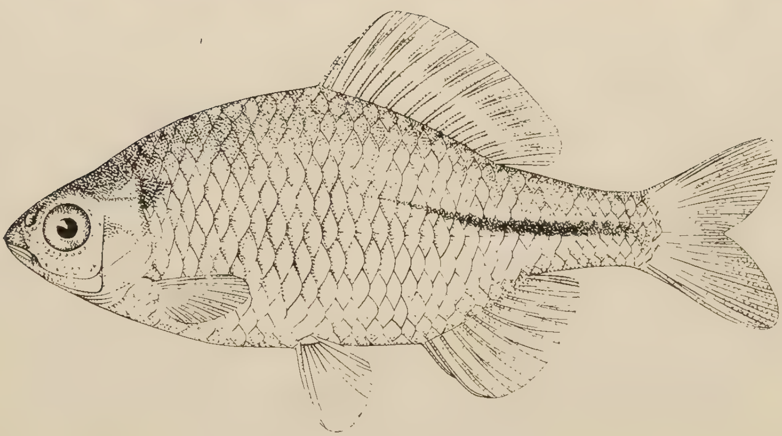
PLATE XIX



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1. ***Acheilognathus rhombeus*** (TEMMINCK et SCHLEGEL), Lake Biwa. ♀
2. ***Acheilognathus rhombeus*** (TEMMINCK et SCHLEGEL), Lake Biwa. ♂
3. ***Acheilognathus rhombeus*** (TEMMINCK et SCHLEGEL), Lake Biwa. ♂

oka Prefecture; Takayama, Shibamura, Asakuragun, Fukuoka Prefecture; River, Chikugo, Takayama-gun, Fukuoka Prefecture; Lake Yamanaka, Yamanashi Prefecture; Matsue City, Shimane Prefecture; River Mogami, Oishida mura, Yamagata Prefecture; Niokuchi; Otamimura, Yamagata Prefecture; Yosamura, Hokaigun, Yamagata Prefecture; River Gekko, Fukiuramura, Yamagata Prefecture (OKADA);

Remarks: REGAN described *Acheilognathus smithii* from a small specimen collected at Nodogawa (Probably Yodogawa), Kyôto represented by R. GORDON SMITH, measuring 38 mm. in total length. The difference between this species and the present *A. rhombeus* is so slight and I suppose that the *A. smithii* may be a young of the present species.

Table 35. Measurements of *Acheilognathus rhombeus** (T. et SCH.).

Spec. No.	Date	Locality	Sex	T.L. mm.	B.L.	N.D.	N.A.	N.S.	N.V.	B.L./B.H.	B.L./H.L.	H.L./S.L.	H.L./E.D.	H.L./I.O.	H.L./C.L.	C.L./C.H.	N.P.	N.B
1.	?	Kumamoto	♀	88.7	67.0	Ⅲ,13	Ⅲ,11	38 6/5	33	2.2	3.5	2.9	3.9	2.6	1.5	1.4	?	7+15=22 (inner) 1+8=9 (outer)
2.	?	——	♀	102.5	77.0	Ⅲ,11	Ⅲ,10	38 6/5		2.5	3.6	3.2	3.8	2.4	1.5	1.5	5-5	7+14=21 (inner) 2+8=10 (outer)
3.	?	——	♂	108.7	84.2	Ⅲ,12	Ⅲ,10	37 6/5	34	3.7	3.7	3.0	3.8	2.4	1.4	1.5	5-5	7+16=23 (inner) 3+7=10 (outer)
4.	XI, 1936	Biwa lake Matsubara lake	♂	107.7	83.8	Ⅲ,11	Ⅲ,10	38 6/5		2.3	3.8	3.0	4.1	2.3	1.5	1.3		
5.	——	——	♀	120.1	91.7	Ⅲ,12	Ⅲ,10	35 6/5	34	2.4	3.7	3.0	4.1	2.6	1.6	1.3	5-5	7+17=24 (inner) 2+9=11 (outer)

* This was measured by K. UCHIDA 1939.

35. Acheilognathus moriokae JORDAN et THOMPSON.

"Tanago"

(PL. XX, figs. 1–4)

Acheilognathus limbata JORDAN et FOWLER, 1930, Proc. U. S. N. Mus., xxvi, p. 818, in part.

Acheilognathus moriokae JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, no. 4, pp. 225-226., pl. xxv, fig. 2. – OKADA et IKEDA 1938, Saitô Hô-on kai Mus., Res. Bull., no. 15, pp. 101–102, pl. v, fig. 2. – OKADA et NAKAMURA, 1948, Nihon no Tansuigyo, p. 153, fig. 73.

The original description* is as follows:

Among the specimens recorded from Morioka by JORDAN and FOWLER as *Acheilognathus limbata* is a species which appears to be new. The type is in the collection of Stanford University. Cotypes are in the Carnegie Museum.

*JORDAN et THOMPSON 1914, Mem. Carn. Mus., vol. vi, no. 4, pp. 225-226.

Description of the type, 95 mm. in total length and 75 mm. in length to base of the caudal. Head 4 in body-length; depth of body 2.86; D. III, 9; A. II; 8; thirty-seven scales in lateral line, in transverse series between vertical fins 6/5; pharyngeal teeth 5-5.

Tip of premaxillaries at level of, or slightly below, lower edge of pupil; snout slightly overhanging premaxillaries; mouth not very oblique; gill-rakers 2 12, of equal length throughout; pharyngeal teeth smooth, with a narrow grinding surface and hooked tip; lateral line complete; barbel a quarter of diameter of eye in length, or less, somewhat coarse in texture; depth of caudal peduncle 2 in length of head, its length 1.14 in same, or 4.5 in body-length.

Description: Dorsal inserted midway between tip of snout and base of caudal; its base 1.25 in head; its length 1.5; anal inserted under last dorsal ray, its base 1.7 in head, its height the same, first branched ray extending beyond base of last; margin of fin somewhat falcate; ventrals under dorsal insertion, their length equal to anal height; that of pectorals slightly greater.

A blue-black lateral stripe along sides of caudal, its width over half as wide as eye, tapering to a point under first dorsal rays and shortly before base of caudal; shoulder-spot very indistinct, diffuse, extending posteriorly over five of six scales. Dorsal slightly margined with black, three narrow white stripes alternating with dark ones on median part of fin; anal nearly colorless, with traces of white stripes on middle of rays; other fins colorless. In a cotype the ventral and anal fins are dusky, but with a clear edge.

Of this species we also have a number of specimens from Lake Biwa, resembling the type in every respect. It is distinguished from other species by the number of the fin-rays, short dorsal base, broad lateral stripe, indistinct shoulder-spot, and short barbel. From *Acheilognathus tabira* it is distinguished by a less oblique mouth, serrated pharyngeal teeth, smaller eye, less depth, more falcate anal, the first developed ray extending always beyond the insertion of the last, and one less ray in both the dorsal and anal. In none of our specimens is shoulder-s ot so distinct as in *Acheilognathus tabira.*

A specimen from Funayado, Kyushu, collected by JORDAN and SNYDER, is a female differing from this species by one less ray in the anal, a very short barbel, and shorter fin-bases. The lateral line is complete, the pharyngeal teeth smooth, with a very narrow grinding surface.

Remarks: The present species somewhat resembles with *Acheilognathus cyanostigma* JORDAN et FOWLER but differs from it in having a small indistinct black spot just behind the upper posterior margin of opercle and the longitudinal median dark green line somewhat pointed at end. JORDAN and THOMPSON* has remarked that the present species is distinguished from other species by the number of the fin-rays, short dorsal base, broad lateral stripe, indistinct shoulder-spot, and short barbel. They also stated that from *Acheilognathus tabira*, it is distinguished by a less oblique mouth serrated pharyngeal teeth, smaller eye, less depth, more falcate anal, the first developed ray extending always beyond the insertion of the last, and one less ray in both the dorsal and anal. In none of our specimens is the shoulder-spot so distinct as in *Acheilognathus tabira.*

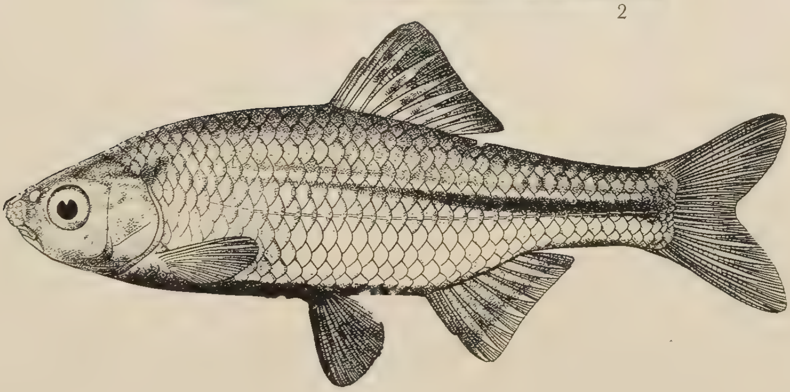
* JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, no. 4, p. 226.



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2



3



4

1. ***Acheilognathus moriokae*** JORDAN et THOMPSON. ♂ ×1
   Ozamenuma, Aomori Prefecture.
2. ***Acheilognathus moriokae*** JORDAN et THOMPSON. ♀ ×1
3. ***Acheilognathus moriokae*** JORDAN et THOMPSON. ♂ ×1.5
4. ***Acheilognathus moriokae*** JORDAN et THOMPSON. ♂ ×1.5

Habits: In the breeding season, the male has a nuptial color on the body. It shows greenish blue on the back and lateral and light red on near the belly. The belly black.

Table 36. Measurements of *Acheilognahus moriokae* JORDAN et THOMPSON*.

Reg. NO.	Standard length	Depth of body	Head	Snout	Eye	Interorbital space	Maxillary	Depth of Caudal-peduncle	Barbel
	mm.	in L.	in L.	in H.	in H.	in H.	in H.	in H.	in S.
11378	59.5	3.2	3.8	2.8	3.8	2.7	4.5	2.3	3.5
——	61.4	3.2	3.6	2.8	3.5	2.6	4.6	2.3	2.4
——	61.8	3.2	3.9	2.9	3.5	2.4	3.7	2.3	3.5
——	63.5	3.1	3.6	2.8	3.7	2.6	5.5	2.3	3.0
——	67.5	3.4	3.8	3.0	3.5	2.5	4.4	2.3	2.9
——	68.7	3.1	3.8	2.8	3.9	2.6	5.0	2.1	3.2
——	72.9	3.3	3.9	2.7	3.7	2.5	4.3	2.1	2.8
——	73.1	3.0	3.8	2.7	4.0	2.4	4.8	2.3	3.0
11739	42.7	3.3	3.9	3.1	3.1	2.2	4.1	2.1	3.6
11832	37.6	3.4	3.8	3.0	3.0	2.5	4.3	2.2	3.7
11875	68.3	3.2	3.9	3.3	3.3	2.5	5.4	2.1	3.7
15775	50.7	3.2	3.6	3.7	3.2	2.8	6.0	2.4	2.9
——	50.9	2.9	3.3	3.5	3.3	2.9	5.6	2.4	3.3
——	51.6	3.3	3.7	3.5	3.1	2.6	5.4	2.5	2.7
——	56.0	3.2	3.5	3.4	3.6	2.9	5.2	2.6	2.8
——	56.8	3.2	4.0	3.1	3.3	2.5	4.9	2.4	3.5
15991	40.7	3.3	3.5	3.0	3.1	2.9	4.7	2.6	2.9
——	45.4	3.4	3.6	3.2	3.2	2.8	4.5	2.6	2.6
——	46.5	3.2	3.5	3.1	3.1	2.6	4.9	2.4	2.8
——	48.5	3.4	3.5	3.1	3.3	2.7	4.6	2.7	2.9
——	49.6	3.5	3.6	3.1	3.2	2.6	5.0	6.2	2.9

*These measurements are made by IKEDA and myself. The specimens are preserved in Saitô Hôonkai Museum, Sendai, Japan.

Table 37. Measurements of *Acheilognathus moriokae* (continued).

Number of fin rays		Preorbital	Number of Scales		
D.	A.		in L.L.	above L.L.	below L.L.
III, 9	II, 9	15	34	5	4
III, 9	II, 9	14	34	6	5
III, 9	II, 9	15	36	7	5
III, 9+1	II, 8	14	35	6	4
III, 9	II, 8	16	36	6	5
III, 9	II, 8	16	34	6	5
III, 9+1	II, 8+1	17	34	6	6
III, 9	II, 8	15	36	6	5
III, 8	II, 8	15	34	5	5
III, 8+1	II, 8	15	35	6	5
III, 8	II, 8	15	35	6	4
III, 9	II, 8	15	36	6	5
III, 8	II, 7+1	16	37	6	5
III, 9	II, 8	16	37	6	5
III, 8	II, 8	15	37	5	5
III, 9	II, 8	16	35	6	5
III, 9	II, 8	16	33	6	4
III, 9	II, 8	15	35	6	5
III, 9	II, 8	16	36	6	5
III, 9	II, 8	15	36	6	5
III, 6	II, 8	16	37	6	5

Dorsal and ventral fins black and anal fin based with black and margined with white.

The ovipositor of female light grey with faint reddish provided with long ovoidal and elliptical eggs. The breeding season is in spring.

Type locality: Morioka

Distribution: Morioka (JORDAN & FOWLER); Lake Biwa (JORDAN & THOMPSON); Northern Kyushû; Niigata Prefecture; Lake Kasumigaura, Ibaraki Prefecture; Miyagi Prefecture; Fukushima Prefecture; Morioka, Iwate Prefecture (OKADA & IKEDA); Yusamura, Hokaigun, Yamagata Prefecture (OKADA); Nikuchi, Otomimura, Yamagata Prefecture (OKADA); Tsuruoka City, Yamagata Prefecture (OKADA); Shiroshimachô, Sanchogun, Fukuôka Prefecture (OKADA); Isahaya, Nagasaki Prefecture; Uragami River, Nagasaki Prefecture (OKADA); River, Mogami Sakata City, Yamagata Prefecture; Oishidamura, Yamagata Prefecture; Yusamura Hokaigun, Yamagata Prefecture; Tokayama, Shihamura, Asakuragun, Fukuoka Prefecture; Tokura, Nagano Prefecture; Sanbonbune, Aizu, Fukushima Prefecture; Yamaguchi, Inumagun, Saitama Prefecture; Lake Abashiri, Hokkaidô; Mokotoko, Hokkaidô; Chikuma River, Uminokuchi Yamaguchi Resevoir, Inumagun, Saitama Prefecture; Murakami Iwafune-gun, Niigata Prefecture; Tatebayashi; Gumma Prefecture; Minamihama, Shiga Prefecture; Isononaiko, Shiga Prefecture; Hirata, Shiga Prefecture; Sugoshi, Shiga Prefecture; Lake Yogo, Lake Osoresan, Aomori Prefecture; Lake Matsubara Shiga Prefecture; Hirata, Biwa Lake, Shiga Prefecture; Seta, Lake Biwa, Shiga Prefecture; Yamada, Lake Biwa, Shiga Prefecture; Jorakuji, Lake Biwa, Shiga Prefecture; River Miomote, Murakami, Iwafune-gun, Niigata Prefecture; Lake Panke, Hokkaidô; Lake Akan Hokkaidô; Onuma, Hokkaidô; Lake Abashiri, Hokkaido; River Katsura, Minamitsurugun, Yamanashi Prefecture; River Ka, Shiobaragun, Fukuoka Prefecture (OKADA).

36. Acheilognathus tabira JORDAN et THOMPSON.

"Tabira"

(PL. XXI, figs. 1-3)

Acheilognathus tabira JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, no. 4, pp. 220-221, pl. xxv, fig. 1. - TANAKA, 1921, Nihon Gyogaku, p. 181, pl. 3, fig. 15. - OKADA, 1934, Sci. Rep. Tokyô Bunrika Daigaku, vol. 2, no. 28, pp. 31-35, pl. 3, fig. 1. - MIYADI, 1935, Kyôtofu Tansuigyo,, p. 23. - OKADA et NAKAMURA, 1948, Nigon Tansui Gyorui, pp. 153-154, fig. 74.

Acheilognathus limbata JORDAN et FOWLER, 1930, Proc. U. S. N. M., xxvi, p. 818. - TANAKA, 1908, Ann, Zool. Jap., vii, part 1, pp.

Paracheilognathus tabira UCHIDA, 1939, Fishes of Tyôsen, part 1, pp. 160-161, fig. 14.

The original description* is as follows:

Type specimen. No. 6007a, Lake Biwa at Matsubara.

*Memoirs of the Carnegie Museum, 1914, vol. vi, no. 4, pp. 220-221, pl. xxv, fig. 1.

The types of this species are the original of the description of *Acheilognathus limbata* JORDAN and FOWLER, although the specimens utilized by them were mingled with *A. moriokae* JORDAN and THOMPSON. They are now in the collection of Standford University.

Described from numerous specimens No. 6007a type, No. 6016, forty specimens from Lake at Matsubara, collected by Dr. JORDAN in 1911 and by JORDAN and SNYDER in 1900, ranging in length from every young to 85mm. in total length. Depth 3.12 in body-length; D. III, 9 or 10; A. II, 9 or 10; scales in lateral line thirty-six of thirty-seven, in transverse series from first rays of vertical fins 6/5; pharyngeal teeth 5–5 (occasionally 6–5 or 5–6).

Head 4 in body-length; snout 3.66 in head; mouth very oblique, anterior edge of premaxillaries slightly above lower margin of pupil, the region of the articulation of the mandible prominent; profile of snout arched above nostrils, not at tip of snout, which it does not overhang; eye large; gill-rakers 2+7; pharyngeal teeth hooked, with narrow grinding surface, some of them always serrated or folded on the lower lateral surface, although all are not usually so; lateral line complete; barbel very minute, fine of texture, less than one-fourth diameter of eye in length; caudal peduncle slightly more than tice in head, its length 1.25; breadth of body 2 in head.

Dorsal inserted nearly midway between snout and base of caudal, its base 1.2 in head, its height (first rays) 1.5, these when depressed just reaching base of last ray; anal inserted under last dorsal rays, its base 1.5 in head, its margin nearly straight, tips of first rays not reaching base of last; height of first rays 1.66 in head; ventrals as long as anal rays, inserted under first dorsal ray; pectorals 1.25 in head.

Color plain, save for a blue-black lateral stripe along center of caudal peduncle, nearly half as wide as pupil, tapering to point under center of dorsal, its broadest part on caudal peduncle, not reaching caudal; a sharply margined bue-black shoulder spot as large as pupil; dorsal with two clear stripes half way up the rays, alternating dark, the marking being dusky; anal similar; other fins colorless, save the dusky caudal peritoneum black.

This species is very hard to distinguish superficially from *Acheilognathus moriokae*, from which it differs in more oblique mouth, less falcate anal fin, larger eye, and less strongly marked coloration. The most striking difference is in the plication of the teeth.

All the males of this species in hand have lesser depth than the females; anal black, edged with white ventrals black, the first two rays white; and the ventral surface of the belly black or pigmented.

Our only specimen from Okayama, a male, has a shorter caudal peduncle and smaller eye than any of our examples from Lake Biwa, and is much paler in color. One specimen from Nagoya has a similar caudal peduncle, but is in other respects similar to specimens from Lake Biwa.

Description: Head 4; depth 3; D. III, 10; A. III, 10; P. 15; V. 8; scales 36 in lateral line; and 6 scales between the latter and middle of belly; pharyngeal teeth 5–5; width of head $1\,^3/_4$ in its length; snout 4 in head; eye 3; inter-orbital space $2\,^3/_4$; pectoral $1\,^1/_6$; ventral $1\,^1/_2$.

Body rather elongate, moderately deep, and compressed. Head short 4 in body-length, and compressed; snout short, 3.66 in head, rather blunt and not produced; eye rather large, anterior; mouth small, very oblique, and reaching below the nostril; anterior edge of premaxillaries slightly above lower margin of pupil; maxillary protractile, and furnished with a small barbel which is seldom more than half the eye in length; nostrils close together, and near the upper part of eye; interorbital space rather broad, slightly elevated and flattened medially. Pharyngeal teeth with a narrow grinding surface, smooth, and without serrations. Gill openings rather large; gill rakers 2+7, smooth, and without serrations but some of them serrated or folded on the lower lateral surface, pseudobranchial present. Lateral line complete; caudal peduncle slightly more

than twice in head, its length 1.25, breadth of body 2 in head. Intestine with numerous convolutions. Peritoneum black.

Scales large, cycloid, and narrowly imbricated in the costal region; no pectoral flap; a short, scaly, ventral flap.

Origin of dorsal about midway, or a trifle in advance, in the length of the body without caudal, the anterior rays the highest, the base of the fin about $4\,^1/_3$ in body without caudal, the third rudimentary ray as long as first developed ray and rather strong, and the margin of the fin straight; origin of anal below the middle, or a trifle posterior, base of dorsal much nearer the origin of ventral than base of last anal ray, similar to dorsal in shape, with the anterior rays the highest, the base of the fin less than head without snout, and the margin of the fin nearly straight; caudal very deeply emarginate, the lobes well developed and pointed; pectorals equal the head from anterior nostril to the ventrals; ventrals slightly in front of the origin of the dorsal, and reaching beyond the origin of the anal. Caudal peduncle rather long, its least depth $2\,^1/_4$ in head. Lateral lines nearly straight, and continuous along the sides to the base of caudal.

Color plain, save for a blue-black lateral stripe along center of caudal peduncle, nearly half as wide as pupil, tapering to point under center of dorsal, its broadest part

Table 38. Measurements of *Acheilognathus tabira* JORDAN et THOMPSON*.

Sp. No.	Locality	Date	Sex	T.L.	B.L.	N.D.	N.A.	N.S.	N.V.	B.L./B.H.	B.L./H.L.	H.L./S.L.	H.L./E.D.	H.L./I.O.	H.L./C.H.	N.P.	N.G.
				mm.													
1	Biwa Lake	XI, 1936	♂	69.0	51.5	Ⅲ,10	Ⅲ,9	$39\frac{6}{4}$	35	2.6	4.1	3.4	2.8	2.2	1.2	4–4	9+18=27 (inner) 2+8=10 (outer)
2	……	……	♀?	77.9	59.9	Ⅲ,10	Ⅲ,9	$38\frac{6}{4}$	35	2.7	4.0	3.4	3.1	2.4	1.2	4–5	8+18=26 2+9=11
3	……	……	♂	78.4	60.1	Ⅲ,10	Ⅲ,9	$36\frac{6}{4}$		2.7	3.9	3.4	3.1	2.4	1.3		
4	……	……	♂?	79.7	60.7	Ⅲ,10	Ⅲ,9	$39\frac{6}{4}$	36	2.8	3.8	3.3	3.0	2.5	1.6	?–4	9+18=27 (inner) 2+6=8 (outer)
5	……	……	♀	81.4	61.4	Ⅲ,10	Ⅲ.9	$38\frac{6}{4}$	34	2.9	3.9	3.3	3.2	2.4	1.6	5–5	broken 3+8=11 (outer)

*Measured by K. UCHIDA, 1939, Fishes of Chôsen, p. 161.

Abbreviation:

T.L.	Total length	H.L.	Head length
B.L.	Body length	S.L.	Snout length
ND.	Number of Dorsal fin	E.D.	Eye diameter
N.A.	Number of Anal fin	I.O.	Interorbital space
N.S.	Number of Scales	C.H.	Height of Caudal peduncle
N.V.	Number of Vertebrae	N.P.	Number of Pharyngeal teeth
B.H.	Body height	N.G.	Number of Gill-rakers

PLATE XXI



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1. ***Acheilognathus tabira*** JORDAN et THOMPSON. ♂ × 1
2. ***Acheilognathus tabira*** JORDAN et THOMPSON. ♀ × 1
3. ***Acheilognathus tabira*** JORDAN et THOMPSON. ♀ × 1.5

on caudal peduncle, not reaching caudal; a sharply margined blue black shoulder spot as large as pupil; dorsal greyish with 3 darker longitudinal bands; caudal greyish, with several darker cross bands; pectorals greyish; ventrals and anal black, with white edges; lower surface of the head pale or whitish. In the breeding season, male shows beautiful greenish blue on dorsal and light red and black on belly. Dorsal fin black or faintly red; base of anal black, margined with anal fin black, margined with white along the anterior edge. Female has light greyish ovipositer.

Distribution: Lake Biwa, Matsubara; Karasaki; Lake Yogo (JORDAN, SNYDER, THOMPSON); Iba, Matsubara; Okayama; Nagoya (JORDAN & THOMPSON); Tsuchiura, Ibaraki Prefecture; River Iwai, Ichinoseki, Nagoya; River Kitakami, Moriaka

Table 39. Measurements of *Acheilognathus tabira* (JORDAN et THOMPSON).

Collection	Fish. Mie Univ.*				
Total length	66.0mm.	68.0mm.	70.0mm.	56.0mm.	71.0mm.
Body length	53.5	55.0	57.2	45.2	59.6
Body length/Head	4.18	4.24	4.28	4.12	4.32
Body length/Depth	3.06	2.85	2.98	3.02	3.08
Body length/Predorsal length	2.06	2.12	2.02	2.06	2.13
Body length/Prepectoral length	4.45	4.57	4.57	4.58	4.58
Body length/Preventral length	2.23	2.20	2.12	2.22	2.21
Body length/Preanal length	1.62	1.59	1.59	1.66	1.66
Head/Snout	4.26	4.33	3.80	3.94	3.95
Head/Upper jaw	4.56	4.65	4.92	4.93	4.94
Head/Interorbital width	2.56	2.36	2.46	2.60	2.60
Head/Diameter of Eye	3.88	3.42	3.50	3.42	3.45
Head/Length of Caudal peduncle	1.00	0.98	1.16	1.10	1.02
Head/Depth of Caudal peduncle	1.97	1.86	1.90	2.08	1.92
Head/Length of Dorsal fin	1.28	1.30	1.18	1.32	1.21
Head/Length of Anal fin	1.54	1.44	1.40	1.57	1.45
Head/Height of Dorsal fin	1.22	1.18	1.30	1.16	1.17
Head/Height of Anal fin	1.54	1.67	1.51	1.75	1.34
Head/Pectoral length	1.44	1.44	1.48	1.41	1.45
Head/Ventral length	1.75	1.57	1.71	1.56	1.53
Date	V, 1955				
Locality	Lake Biwa, Shiga Prefecture				

* Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

(JORDAN & FOWLER); Shiroshimacho, Fukuoka Prefecture (OKADA); River Yanagawa, Fukuoka Prefecture; River Yabe, Fukuoka Prefecture; River Chikugo, Shiroshimachô, Fukuoka Prefecture; Shirakawa Tochinoki, Aso-gun, Kumamoto Prefecture; River Chikugo, Ayukaeshi water fall, Kumamoto Prefecture (OKADA).

Remarks: The fish are mostly found in clear streams, and sometimes in 20 m. deep waters of Lake Biwa. Omnivorous. The breeding season is in spring; the female deposited an elliptical eggs in the branchial chambers of freshwater bivalve.

37. **Acheilognathus lanceolatus** (Temminck et Schlegel).

Spear-chub Bitterling, "Yaritanago"

(Text-fig. 63)

Capoeta lanceolata Temminck et Schlegel, 1846, Fauna Japonica Poiss., p. 202, pl. C, fig. 3.

Acheilognathus lanceolatus Jordan et Thompson, 1914, Mem. Carn. Mus., vol. vi, no. 4, pp. 224–225. – Fowler, 1910, Proc. Acad. Nat. Sc. Phil., p. 478. – Okada, 1934, Sci. Rep. Tokyô Bunr. Daig., sect. B, no. 28, pp. 31–35, pl. iii, fig. 3. – Okada, Uchida et Matsubara, 1935, Nihon Gyorui Zusetsu, p. 83, pl. 28, fig. 1.

Acheilognathus lanceolatum Jordan et Snyder, 1900, Proc. U. S. N. M., vol. xxiii, p. 344. – Jordan et Snyder, 1901, Prel. Check List Fish. Japan, p. 47. – Snyder, 1912, Proc. U. S. Nat. Mus., vol. xiii, p. 404. – Ui, 1932, Kisyu Gyofu, p. 20.

Acheilognathus lanceolata Jordan et Fowler, 1903, Proc. U. S. Nat. Mus., vol. xxvi, pp. 819-820. – Tanaka, 1909, Ann. Zool. Jap., pt. ii, pp. 132–133. – Tanaka, 1921, Nihon Gyogaku, p. 183. – Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 162. – Ueno et Miyadi, 1935, Shinsyû no Gyorui, pp. 215-216, fig. 113. – Miyadi, 1935, Kyôtofu Tansuigyo, pp. 23–24, pl. 3, figs. 16, 16a. – Okada et Ikeda, 1938, Saito Hô-on kai Mus., Res. Bull. no. 15, pp. 100–101, pl. v, fig. 1. – Okada et Nakamura, 1948, Nihon Tansui Gyorui, pp. 154–155, fig. 72.

Acheilognathus intermedia Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 162.

Capoeta intermedia Schlegel et Temminck 1846, Fauna Japonica, p. Poiss., 203, pl. C, fig. 4.

Acheilognathus intermedius Ishikawa, 1895, Zool. Mag., p. 128. Jordan et Thompson, 1914, Mem. Carn. Mus., pp. 223-224.

Acheilognathus melanogaster Bleeker, 1860, Act. Soc. Sci. Indo. Nedrl. Japan, vi, p. 92, pl. ii, fig. 1. – Sauvage, 1883, Bull. Soc. Philom., d. 3. – Günther, 1868, Cat. Fish, vii, p. 278. – Ishikawa, 1897, Prel. Cat., p. 12. – Günther, 1880, Shore Fishes, Challenger, p. 72.

Acheilognathus intermedius Günther, 1868, Cat. Fish., vii, p. 278. -Sauvage, 1883, Bull. Sci. Philom., p. 3. – Ishikawa, 1897, Prel. Cat., p. 12.

Acheilognathus signifer, Mori, 1928, Chôsen Nat. Hist. Soc., no. 6, p. 62.



Text-fig. 63. ***Acheilognathus lanceolatus*** (Temminck et Schlegel). × 1.5

The original description* is as follows:

Capoeta lanceolata

La troisieme de Capoètes du Japon, tout en effrant une organisation assez semblable à celle des deux espèces précédentes, s'en distingue au premier abord par son corps plus élevé et plus comprimé, ainsi

* Temminck et Schlegel, 1846. Fauna Japon. Poiss., p. 202, pl. C, fig. 3.

que par le nombre différent des rayons de ses nageoires.

La grosseur du corps vis-à-vis de labase de la dorsale est trois fois dans sa hauteur, qui elle-même entre trois fois et demie dans la longueur comprise entre l'extrémité du museau et l'échancrure de la caudale. La tête est quatre fois et deux tiers dans cette longueur, et le museau entre quatre fois et un tiers dans la tête. L'aeil est assez voluineux et son diamètre occupe plus du tiers de la longueue de la tete; l'entre-deux des yeuxn' est guère plus considérable que le diamètre de ces organes. Le dessus de la tête est arrondi vers les côtés, et le museau est hombé en ressus. La bouche est étroite, et le maxillaire ne s'etehd en arriere, malgré la brièveté du museau, que jusque sous l'aplomb du bord postèrieur des orifices de la narine; le bord de l'intermaxillaire atteint l'extremité du museau, et la fente dela bouche forme avex l'axe longitudinal du corps un angle d'environ quarante degres. Les barbillons sont extrêmement grêles, et leur longueur surpasse d'un quart le diamètre de l'aeil. La ligne latérale forme une inflexion vers le bas et est en général plus rapprochée de la ligne du ventre que de celle du dos. Les écailles semblables à celles des espèces précédentes sont au nombre de 37 sur la ligne latérale; et il y en a, entre le dos et le ventre, 11 rangées, dont 5 au dessus de la ligne latéra le. L'anus est un peu plus rapproché de la tête que de l'échancrure de la caudale, et s'ouvre sur la fin du deuxième tiers de la distance comprise entre l'aiselle des ventrales et le commencement de l'anale.

Les pectorales, placées comme à l'ordinaire, en ligne horizontale derriere la bouche, égalent la tête sans le museau; leur extremité est éloignee de la base des ventrales du tiers deleur longueur. Ces dernières nageoires sont tant soit peu plus courtes que les pectorales, leur pointe dépasse un peu l'orifice de l'anus et se prolonge jusque vers le commencement de l'anale, dont la hauteur par dgvant égale à peu de chose pres la longueur des ventrales, et dont le bord inférieur est droit. La caudale est, comme d'ordinaire, échancree au milieu. La dorsale nait vis-à-vis du milieu de la base des ventrales; sa hauteur par devant fait plus de la moitié de la hauteur du tronc, et son bord supérieur est droit. D. 3+8; A. 2+9; V. 1+7; P. 15; C. 19.

Le seul exempbaire que nous possédons de cette espèce porte trois pouces en longeur totale, et est conservé dans l'esprit devin. Il est d'un brun rougeâtre, foncé sur le dos, très-clair sur le ventre et offrant des reflets argentés, notamment sur les flancs et les opercules. On voit dans la région de la cinquième écaille de la ligne latérale une tache mal déterminée d'un bleuâtre pale. Les nageoires sont jaunâtres, mais la caudale offre une faible nuance brune, et les membranes des rayons de la dorsale sont traversées au milieu par une raie brunâtre assez large.

Description: Head about 4 in body length; depth 3; D. III, 8; A. II, p; P. 15; V. 8; scales 34–37 in the lateral line; 6 scales between the latter and middle of belly; pharyngeal teeth 5–5, with rather grinding surface; width of head $1^3/_4$ in its length; snout slightly longer than diameter of eye; eye $3^1/_4$ in head; interorbital space $2^2/_3$; pectoral about $1^2/_5$; ventral $1^1/_2$.

Body rather elongate, moderately deep and compressed. Head short, compressed; snout short and bluntly rounded; eye moderately large, anterior; mouth small, oblique, anterior edge of premaxillaries level with lower edge of pupil and protractile; maxillary barbel long, equal to snout but little shorter than eye; pharyngeal teeth, hooked with narrow grinding surface, and uncolored; nostrils close together in front of the eye above; interorbital space broad; slightly elevated, and flattened in the middle. Gill-opening rather large; gill-rakers short, slender, 2 + 8, pseudobranchiae well developed. Intestine with numerous convolutions. Peritoneum black.

Scales large, cycloid, and some narrowly imbricated on the sides; no pectoral flap; ventral flap small.

Dorsal insertion midway between snout and base of caudal, its base 1.33 in head, its

height 1.5; the anterior rays the highest, the third rudimentary ray more or less stiff and strong, and the margin of the fin nearly straight; and inserted under last dorsal ray, its base 1.5 in head, its height the same, its margin straight, similar in shape to the dorsal, the anterior rays the highest, the base of fin less than head without snout, the third rudimentary ray stiff, and the margin of the fin nearly straight; caudal deeply emarginate, the lobes pointed; pectorals reach a little over two-thirds the distance to origin of ventrals; ventrals 1.83 in head inserted under first dorsal ray and reaching to within a short distance of origin of anal. Caudal peduncle measured from last anal ray, its depth moderate, 2 in head. Lateral line complete, slightly decurved, and continued to base of caudal.

Color in alcohol plain, except the abdomen and ventrals, which are blackish; a very pale and undistinct brown spot above gill-opening, and a pale indistinct brown or grayish stripe along the side above the lateral line, and posteriorly; dorsal and anal grayish, with several longitudinal dark bands across the former and the latter broadly edged with whitish; caudal and pectorals grayish. Peritoneum silvery with black reticulations.

Secondary sexual characters: A pearl organ disc appears on each side of the snout and around the orbit of the male. The nuptial color of the male shows black from throat to belly and dorsal and anal fins. The anterior lateral side of the body shows a very beautiful reddish orange and two or three reddish orange longitudinal stripes running on the dorsal and anal fins. According to TAMAO SAITO's (1936) studies, if

Table 40. Measurements of *Acheilognathus lanceolatus* (T. et SCH.).

Collection	O.H.B.S.*		Fish. Mie Univ.**		
Total lengh	95.0mm.	72.0mm.	68.0mm.	65.0mm.	66.0mm.
Body length	78.0	59.0	54.5	50.2	52.0
Body length/Head	3.90	3.93	4.10	3.98	4.00
Body length/Depth	2.78	2.68	3.27	3.27	3.25
Body length/Predorsal length	1.70	1.97	2.06	2.05	1.96
Body length/Prepectoral length	4.33	3.93	4.19	4.36	4.16
Body length/Prevental length	2.00	2.03	2.13	2.19	2.13
Body length/Preanal length	1.56	1.55	1.60	1.62	1.57
Head/Snout	3.00	3.00	3.81	3.50	3.73
Head/Interorbital width	2.50	2.50	2.30	2.52	2.34
Head/Diameter of Eye	4.00	3.00	2.96	2.80	3.25
Head/Length of Caudal peduncle	1.25	1.25	1.18	1.12	1.15
Head/Depth of Caudal peduncle	2.00	1.66	1.99	2.10	2.09
Head/Length of Dorsal fin	1.25	1.25	1.45	1.40	1.44
Head/Length of Anal fin	1.67	1.50	1.56	1.66	1.62
Head/Height of Dorsal fin	1.25	1.50	1.23	1.33	1.24
Head/Height of Anal fin	2.00	1.66	1.66	1.68	1.67
Head/Pectoral length	1.54	1.50	1.43	1.33	1.33
Head/Ventral length	1.82	1.88	1.62	1.58	1.53
Date	III, 1958		VIII, 1955		
Locality	Lake Biwa		Kumamoto		

* Ôtsu Hydrobiological Station, at Ôtsu, attached to Kyôto University.
**Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

single drop of enarmon is injected into the muscle of the matured female of 100 mm. body length, the ovipositer extends into 20 mm. long, in half an hour. By the injections of Synhormon and Puberozen, the nuptial colorations appears in the dorsal and anal fins of the female within half an hour. The fish mature in 1–2 years after hatching. The adult male shows a distinct nuptial color and the female has a pinkish ovipositor.

Habits: The lives in clear lake, swamp, river and stream. Around Tôkyô, the breeding season occurs in April to June. The eggs are deposited in the branchial cavity of *Inversidens japonensis* by intrusion of the ovipositor. Eggs are yellow, elliptical, 1.4 mm. × 2.5mm. in size. The larvae stay in the branchial cavity for a while after hatching. When they absorb the yolk sac and grow to 8.5 mm. in body length, they leave the host vivalve and swim into the waters. The adult fish live solitary in the current water of a river or in ponds and swamps where the water plants grow densely. The foods is consisting of pelagic crustaceans, worms and aquatic insects.

Development: Egg: Yellow, elliptical, 2.3 × 1.5 mm. in diameter. The incubation period has not yet been ascertained.

Larva: With 7.6mm body length, total length, 7.66 mm, diameter of eye, 0.35 mm, myomeres 13 to vent plus 15 behind. Body slender, yellowish, with a bulbous yolk sac reaching to vent by a narrow posterior portion. Mouth inferior; rays developing ventrally at lophocercal caudal, and position of dorsal indicated by a concertration in the marginal fin fold. Pigmentation: Eye is greyish; a black linear pattern, along the middle of both lateral sides, runs from the base of pectoral to the caudal peduncle.

Juvenile with 8.4 mm body length: Total length, 8.40 mm; body length, 7.12 mm; bodyheight, 1.40 mm; head length, 1.76 mm; diameter of eye, 0.75 mm; snout length, 0.25 mm; myomeres 15 to vent (incomplete) plus 17 behind. Body rather stout, elongated, head blunt at the end; mouth oblique, lower jaw included, maxillary to pupil and eye very large. The development of the rays begins in the dorsal and caudal fins but pectoral remains as a fin fold. Larval marginal fin persists behind dorsal and also ventrally. At this time, the young has reduced the yolk sac and swims out from the mussel. Pigmentation: Many black pigment appears on the top of head extending backward on the dorsal region of the body in irregular series to form the caudal pigmentation. The pigments are also distributed on snout and cheek, aspect of pectoral, while large stellate spots appear on the dorsal and ventral rays, as well as on the ventral ridge marking the myomeres.

Juvenile with 12.5 mm body length: Total length, 12.57 mm; body length, 10.19 mm; body height, 2.49 mm; head length, 2.90 mm; diameter of eye, 1.09 mm; snout length, 0.55 mm. Body compressed, rather broad; snout pointed and oblique; all of the fins nearly well formed; caudal fin is deeply forked. Pigmentation: Chromatophores appear thickly on the top of head and on the dorsal and lateral regions as well as on the snout and cheek. The metallic blue pigment which is characteristic of the young fish, is developed on the stomach region of body.

Distribution: The present species is a very common bitterling in Japan, distributed

in Honshû excepting Aomori Prefecture, Shikoku and Kyûshû, and not in Hokkaidô. Lake Biwa, Matsubara; Hunayado, Kyûshû (JORDAN & THOMPSON); Lake Biwa Matsubara; Kurume, Katana (FOWLER); Tutiura; River Chikugo, Kurume; River Yodo, Ôsaka; Lake Biwa Matsubara, Katota; Lake Yogo, Mino; Hunayado, Kyûshû; Wakanoura; Nagoya (JORDAN & FOWLER); Kumamoto (WAKIYA); Nô, Niigata (JORDAN & HUBBS); Yamaguti (SNYDER); Bay of Mikawa (ISHIKAWA); Himezi (ABE); Lake Mikata; Kasumigaura (HATTORI); River Sumida (JORDAN); Naka-gun, Ito-gun, Wakayama Prefecture (UI); Shinano (TANAKA); Lake Biwa (JORDAN & SNYDER); Kyôto (MIYADI); Akita Prefecture; Yamagata Prefecture; Fukushima Prefecture (OKADA & IKEDA); Honshû except Aomori Prefecture; Shikoku; Kyûshû (OKADA & NAKAMURA); Shinshû (MIYADI); Ôtsu; Maebara; Matsubara, Lake Biwa (ISHIKAWA); River Tone (TAKATSUKA & AOYAGI); River Shimanto, Kôchi Prefecture (KAMOHARA); Izunuma, Miyagi Prefecture (TANAKA & KUMAGAYA); Kitakata, Fukushima Prefecture (OKADA & AOYAGI); River; Abukuma River, Kitakami Iwate Prefecture; River Omono (IDE & AOYAGI); Lake Shinji, Tottori Prefecture; River Chikugo; River Tama, Kumamoto Prefecture (AOYAGI); River Kino (TANAKA); River Yodo, Lake Biwa; Okayama Prefecture (TANAKA); Ôita Prefecture (TANAKA): Kagawa Prefecture (AOYAGI).

Remarks: JORDAN and THOMPSON* said that the present species is distinguished from others by the absence of strongly marked lateral bands, the long barbels, the number of fin-rays, smooth pharyngeal teeth, proportions of the fin-bases and measuremenst of the caudal peduncle. In 1909, TANAKA, SH., mentioned the present species in paper titled on Freshwater Fishes from Shinano, lives together with *A. limbatus* and the two species are mistaken for one and the same species by most natives not only of this district, but also of other parts of Japan. He also remarked that maxillary barbel longer than in *A. limbatus* (TEMMINCK et SCHLEGEL); a faint lateral band above lateral line, without shoulder spot. Four or five scales between lateral line and origin of anal. In this respect it resembles *A. shimazui* TANAKA, but differs in physiognomy and coloration.

38. Acheilognathus limbatus (TEMMINCK et SCHLEGEL).

"Aburabote, Bote"

(PL. XXII, figs. 1–3; Text-figs. 64, a–e)

Capoeta limbata TEMMINCK et SCHLEGEL, 1846, Fauna Japonica, Poiss., p. 203, pl. C, fig. 5.

Acheilognathus limbatus GÜNTHER, 1868, Cat. Fish., vii, p. 277. - JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, no. 4, pp. 222-223. - OKADA, 1934, Sci. Rept. Tokyô Bunr. Daig., sect. B, no. 28, pp. 30-36. pls. i-iv.

Acheilognathus intermedium JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., xxiii, p. 344.

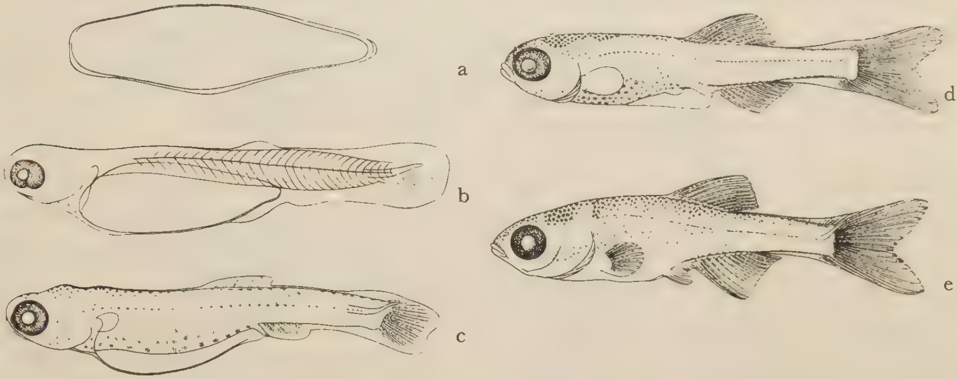
Acheilngnathus limbata, JORDAN et FOWLER, 1903, Proc. Nat. Mus., vol. xxvi, no. 1334, pp. 818-819. - TANAKA, 1909, Ann. Zool. Japon., vol. vii, pt. 2, p. 133. - JORDAN et HUBBS, 1925, Mem. Carn.

*JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. 6, no. 4.

Mus., vol. x, no. 2, p. 162. – MIYADI, 1935, Kôyto fuka Tansuigyo, p. 24. – UCHIDA, 1939, Tyôsen Gyoruishi, pp. 141–150, pl. 11, figs. 4–6, figs. 13. – OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, pp. 155–156, fig. 76.

Acheilognathus limbatum TANAKA, 1921, Nihon Gyogaku, p. 182. – JORDAN et SNYDER, 1901, Prel. Check List Fish. Japan, p. 47.

Acheilognathus shimazui, TANAKA, 1908, Ann. Zool. Jap., vol. vii, pp. 3–5.



Text-figs. 64. ***Acheilognathus limbatus*** (TEMMINCK et SCHLEGEL), after K. UCHIDA.
a. Ripened egg in ovary 4.5 × 1.2 mm.
b. Larva measured 6.8 mm. in body length.
c. Larva measured 8.2 mm. in body length.
d. Free swiming juvenile, measured 9.4–12 mm. in body length.
e. Young.

The original description is as follows:–

Capoeta limbata*

Le corps de cette espèce se rapprochant de la forme rhomboidale, il est facile de la distinguer au premier coup d'aeil des précédentes. Nous en avons quatre individus, dont la taille varie de deux pouces et un quart à deux pouces et demi, mais qui se ressemblent du reste sous tous les rapports.

La grosseur du corps est trois fois dans sa plus grande hauteur, qui entre deux fois et deux tiers dans la longueur comprise entre le bout du museau et l'échancrure de la caudale. La tête est quatre fois et demie dans cette longueur, le museau occupe le premier quart de la tête et sa longueur ets un peu moins considèrable que le diamètre de l'aeil, tandis que l'entre-deux des yeux égale une fois et demie le diamètre de ces organes. Le dessus de la tête est arrondi vers les côtés, et la ligne qui sépare la tete de la nuque forme au milieu une saillie arrondie. Le museau est un peu bombé en dessus. L'ouverture de la bouche est aussi étroite que dans les especes précedentes, mais un peu plusverticale. Les barbillons sont très-grêles et de la longueur du museau ou un peu plus longs. Le troisiéme des sous-orbitaires est grand, un peu anguleux, et sa largeur égale deux tiers du diamètre de l'aeil. Les bords du préopercule forment un angle peu obtus; et l'opercule est très-arrondi à son bord postérieur. La ligne latérale fait au milieu de sa longueur une inflexion assez considérable et étendue. Les écailles, notamment celles des flancs, sont plus élevées que dans les espèces précédentes; on en compte environ 35 sur la ligne latérale, et douze rangées environ entre le dos et le ventre, dont cinq au dessus de la ligne laterale. L'anus s'ouvre un peu en avant de l'anale, et est un peu plus rapproche du bout du museau que de l'échancrure de la caudale.

*TEMMICK et SCHLEGEL, 1846, Faun. Japon. Poiss. p. 203, pl. C, fig. 5.

La dorsale ressemble par sa forme et sa position à celle des espèces Précédentes; elle s'etend jusqu'à la base des ventrales, et sa longueur égale celle da le têet sans le museau. Les ventrales, plus courtes d'un cinquieme que les pectorales, s'ètendent jusqu'un peu au delà du commencement de l'anale. Cette nageoire a son bord inférieur tant soit peu arrondi; sa bauteur par dèrriere n'est que d'un cinquième moins considérable que par devant, ou elle égale la longueur des ventrales. La caudale est assez échancrée au milieu. La dorsale ressemble à l'anale, mais elle est un peu plus élevée; elle nait un peu en arrière de la ligne verticale tirée depuis l'aiselle des ventrales. D. 3+8; A. 2+11; V. 1+6; P. 14; C. 19.

Conservé dans l'esprit de vin, ce poisson est d'un brun rougeâtre, tirant à l'argenteé, notamment sur les flancs. Les opercules offrent de beaux raflets argentés. Les nageoires sont jaunâtres, mais la dorsale ainsi que l'anale offrent des bords noirâtres, et au milieu une bande d'un brun très-pâle, suivie vers le dehors d'une bande semblable blanchâtre, mais également peu apparente.

Description: Head 4 in body length; depth 2.3 in body length to last vertebra; D. III, 8; A. II, 10–11; P. 15; V. 8; scales 33 in lateral line; 6 scales between the latter and middle of belly; pharyngeal teeth 5–5; width of head $1\,^3/_4$ in its length; snout 4 in head; eye 3.12; interorbital space $2\,^3/_4$; pectoral $1\,^1/_6$; ventral $1\,^1/_2$.

Body rather elongate, moderately deep, and compressed, Head short and compressed; snout short, rather blunt and not produced; eye rather large, anterior; mouth small, oblique, and reaching below the nostril; maxillary protractile, and furnished with a long barbel slightly shorter than snout; pharyngeal teeth smooth, not plicate, hooked, with a narrow grinding surface, without color; nostrils close together, and near the upper part of the eye; interorbital space rather broad, slightly elevated and flattened medianly. Gill-opening rather large; gill rakers short, weak, 2+7 in number; pseudobranchial present. Intestine with numerous convolutions. Peritoneum black. Scales large, cycloid, and narrowly imbricated in the costal region; no pectoral flap; a short, scaly, ventral flap.

Dorsal fin inserted nearer base of caudal than tip of snout, distance from snout to first ray 1.66 in body; the anterior rays the highest, the dorsal base slightly less than four-fifths of length of head, its height 1.5 in head; the third rudimentary ray as long as first developed ray and rather strong, and the margin of the fin straight; anal fin inserted under second branched ray of dorsal, its base equal to that of dorsal; its height 2 in head, with the anterior rays the highest and the margin of the fin nearly straight; caudal very deeply emarginate; the lobes well-developed and pointed; pectorals 1.3 in head, equal the head from anterior nostril to edge of opercle, and reach to within a short distance of the origin of the ventrals; ventral fin inserted before dorsal, their length slightly greater than anal height. Caudal peduncle rather long, strongly tapering, its length 1.3 in head, its depth 2. Lateral line nearly straight, complete, and continuous along the sides to the base of caudal.

Color plain, without stripes or spots on the body, dark brown above, tinged with olivaceous, and below paler, except the abdomen, which is black; dorsal margined narrowly with black; a broad band of white below the margin as wide as pupil, the lower part so shaded as to form an indistinct dark band below the white; anal dusky, similar to dorsal, but stripes less distinct; ventrals and pectorals clear; peritoneum black.

Secondary sexual characters: In the male, the soft ray of dorsal fin is nearly equal in length and in parallel with the back line of the body. But in the female, the soft ray of the dorsal fin gradually become shorter posteriorly, higher anteriorly and lower posteriorly in an oblique outline. In the male, a pearl organ disc appears on each side of the snout and the other pearl organs also appear around the orbit. The ovipositor of the female is light grey and as long as the head length. During the breeding, the male shows black on throat and belly.

Table 41. Measurements of *Acheilognathus limbatus* (TEMMINCK et SCHLEGEL).

Collection	Fish. Mie Univ.*		
Total length	62.5mm.	60.0mm.	55.0mm.
Body length	48.0	47.5	42.0
Body length/Head	3.48	3.80	3.86
Body length/Depth	2.85	2.6.	2.78
Body length/Predorsal length	1.92	1.91	1.89
Body length/Prepectoral length	3.55	4.32	4.05
Body length/Preventral length	2.29	2.50	2.24
Body length/Preanal longth	1.66	1.83	1.63
Head/Snout	3.29	3.79	3.67
Head/Upper jaw	3.94	3.68	3.94
Head/Interorbital width	2.61	2.36	2.20
Head/Diameter of Eye	3.74	3.38	3.14
Head/Length of Caudal peduncle	1.77	1.35	1.47
Head/Depth of Caudal peduncle	2.19	1.73	1.90
Head/Length of Dorsal fin	1.42	1.22	1.22
Head/Length of Anal fin	1.45	1.28	1.12
Head/Height of Dorsal fin	1.59	1.59	1.69
Head/Height of Anal fin	1.98	1.60	1.57
Head/Pectoral length	1.38	2.28	1.18
Head/Ventral length	1.54	1.51	1.47
Date	VIII, 1955		
Locality	Kumamoto, Kumamoto Prefecture		

*Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

Habits: This common bitterling is mostly found in streams, shallow waters of river and ponds, making a small school to swim slowly between water vegetaion. They are a spring breeder, spawning during the middle of April and the middle of July. During that season, the males develop pearl organs on the tip of snout, and the nuptial coloration appears, being bright pinkish on pectorals, ventrals, and black greyish on ventral part of head. The females have a rather long, black tubular ovipositor, and lay the eggs in the inharent siphon of a freshwater mussel, *Inversidens japonicus*. The youngs then develop in the inter-lamellar cavities of gills and after absorption of yolk sac, they swim out from the exharent siphon of the mussel. The fish mature in 2 years after hatching. The number of eggs in one individual of 69 mm. body length are over 185 and 128 eggs of which are unripened. These unripened eggs remain for the year. The ripened eggs are deposited in the branchial chamber of vivalve belonging to *Inversidens japonicus*. Unripend egg is cubical while the ripened one is elliptical, measuring 1–1.4 mm. × 3.5–4.2 mm. in size. The hatching out larva stay in the branchial chamber and when

grown up 9 mm. in bony length they leave the vivalve into the waters. The larva of the body length of 23 mm. has a dark stripe appearing along the margin of dorsal fin. This dark stripe moves to the margin, becoming distinct and the other dark stripe appears along the anal fin margin.

They are omnivorous. We examined a few small specimens measuring 8–9 mm. in body length and found very few *Cyclops* and chironomids larvae in the stomach. The alimentary canals of the stages of 18–23 mm. body length were full of *Chironomid* larvae, *Asellus aquaticus*, *Oligochaeta* (by setae), *Cladocera*, but rather small amounts of aquatic vegetation was found. In the young stages, the chief elements of food mostly consits of micro-algae namely, *Diatoms* and micro-green algae as well as very small amounts of animal micro-organisms.

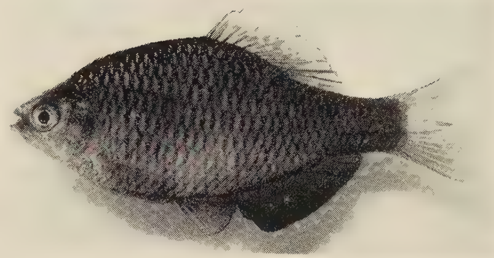
Table 42-a. Measurements of *Acheilognathus limbatus** (T. et SCH.).

Sp. No.	Date	Locality	Sex	Total length	Numb. D. fin rays	Numb. A. fin rays	Numb. scales	Numb. vert.	B.L./B.H.
1.	V, 17–18 1935	Mitsuyoko Korea	♀	50. 0mm.	III, 8	III, 10	$34\frac{5.5}{3.5}$	30	2. 5
2.	——	——	♂	47. 0	—	—	—	31	2. 8
3.	——	——	♀	49. 0	—	—	—	30	2. 5
4.	——	——	♂	52. 0	—	—	—	—	2. 4
5.	——	——	♀	56. 0	—	—	—	—	2. 5
6.	——	——	♀	53. 0	—	—	—	—	2. 5
7.	——	——	♂	61. 0	—	—	—	31	2. 6
8.	——	——	♂	66. 5	—	—	—	30	2. 5
9.	——	——	♀	65. 0	—	—	—	—	2. 6
10.	——	——	♂	65. 0	—	—	—	—	2. 5
11.	III, 18 1936	Chikugo River, Kyûshû	♂	43. 6	—	III, 11	$35\frac{6}{4}$	32	2. 7
12.	——	——	♂	48. 5	—	—	$35\frac{6}{4}$		2. 5
13.	——	——	♂	52. 9	—	—	$35\frac{6}{4}$	32	2. 5

*These measurements were made by K. UCHIDA by Korean specimens and Japanese specimens.

Table 42-b. Measurements of *Acheilognathus limbatus* (T. et SCH.) (Continued).

B.L./H.L.	H.L./S.L.	H.L./E.D.	H.L./I.S.	H.L./C.L.	S.L./B.L.	E.D./B.L.	C.L./C.H.	H.L./C.H.	Numb. Bran. Stegals	Numb. Phary. Teeth
3. 6	3. 5	3. 0	2. 6	1. 5	2. 0	2. 3	1. 2	1. 9		
3. 7	3. 1	3. 1	2. 6	1. 5	2. 0	2. 0	1. 2	1. 9		
3. 6	3. 2	3. 0	2. 6	1. 6	1. 4	1. 4	1. 0	1. 7		
3. 7	3. 1	3. 1	2. 2	1. 6	1. 4	1. 4	1. 0	1. 8	5+14 =19 (inner) 3+ 6 =9 (outer)	5-5
3. 7	3. 2	3. 0	2. 3	1. 8	1. 4	1. 5	1. 0	1. 9		
3. 7	3. 1	3. 1	2. 4	1. 5	1. 4	1. 4	1. 2	2. 0	4+16=20 3+ 6 =9	5-5
3. 7	3. 5	3. 1	2. 2	1. 5	1. 1	1. 3	1. 2	1. 9		
3. 8	3. 0	3. 3	2. 4	1. 5	1. 4	1. 2	1. 2	1. 8	6+15=21 4+ 5 =9	5-5
3. 9	2. 8	2. 8	2. 4	1. 4	1. 2	1. 2	1. 2	1. 8		
4. 0	2. 9	2. 7	2. 2	1. 5	1. 3	1. 4	1. 2	1. 9	5+15=20 3+ 8 =11	5-5
3. 7	3. 4	2. 7	2. 4				1. 4		4+11=15 2+ 5 =7	5-5
3. 8	3. 3	2. 9	2. 4				1. 2			
3. 6	3. 3	2. 9	2. 4				1. 4		4+12=16 2+ 6 =8	5-5



1



2



3

1. ***Acheilognathus limbatus*** (SCHLEGEL). ♂
2. ***Acheilognathus limbatus*** (SCHLEGEL). ♀
3. ***Acheilognathus limbatus*** (SCHLEGEL). ♂

Development: According to K. UCHIDA, the size and depositing number of eggs are variable in each individual. He has examined the female specimen of 53 mm. entire body length, collected at Mitsuyo-ko, Korea on 11–18, June, 1935 and found 3 perfectly ripened eggs and 25 half ripened eggs in her body. The ripened eggs are elliptical measuring 3.6 × 1.0 mm. – 3.8 × 1.2 mm. in size and unripened eggs are nearly cubical, measuring 1.2 × 1.3 mm. in size. He has also observed another female of 63 mm. body length, collected at same locality on 17–18, May, 1934, and mentioned that the ripened eggs were 54 in number, measuring 3.5 × 1.2 mm. – 4.2 × 1.3 mm. while the unripened eggs were 60 in number. From his observation, the larger females have the somewhat more numerous number of eggs than the smaller ones.

Larva of 6.8 mm. total length shows 6.4 mm. body length, 4.4 mm. head and trunk length, 3.1 mm. yolk length and number of myomeres 17 + 17 = 34. The whole body surface is covered by scale-like minute processes. Mouth opened below the head and lower jaw not yet developed. Anus opened; pectoral fin and dorsal fin are originated. Yolk sac is not provided with a process as seen in other species.

Eye is black and a few black chromatophores appear along the ventral side of lateral muscle layer extending from the posterior end of yolk sac to the anal fin.

Larva of 8.2 mm: Entire body length shows 7.4 mm. Body length, 4.7 mm. head and trunk length, 3.0 mm. yolk sac length, provided with myomeres of 17 + 16 = 33 in numbers. Yolk sac still large. The lower jaw well-developed. The fin rays of dorsal and anal fins begin to appear and the caudal fin slightly bifurcate. Black chromatophore distributed densely from the dorsal side of head to the lateral side. They are scattered roughly on the dorsal side of body and from the head to tail, they make a line along the middle between the upper and lower muscular layer. Large, star-like black pigments appear on the lateral side of belly and a few of them on the anal and caudal fins.

Juvenile of 9.4 mm: – Entire body length are free living post-embryonal stage shows 7.7 mm. body length, 4.5 mm. head and trunk length, 1.5 mm. body height and provided with 16 + 17 = 33 myomeres. Black chromatophores are distributed somewhat densely on the head and dorsal side of body and scattered roughly on the lateral sides of head and trunk as well as on caudal peduncle. Large star-shaped pigments are scattered on the lateral ventral side of body. Distinct black lines appear along the mid-longitudinal line of lateral muscle layer of body as well as on both lateral sides of caudal. Black pigments also appear along the fin rays of dorsal, anal, caudal and pectoral fins. This embryos may be a nearly extruding out stage from the mussels.

Juvenile of 17.0 mm: – Total body length show 12.5 mm. body length, 3.5 mm. head length, 7.3 mm. head and trunk length, 3.4 body height. Black chromatophores running along the lateral longitudinal mid-line are burried under the skin and those on dorsal fin somewhat distinct. Black pigment broad band is formed along the immerside of outer margin of the anal fin. The scale is originated in this stage and grows completely in the youngs of total body length of 19 mm.

Distribution: Type locality-streams near Nagasaki. Nagasaki; River Chikugo, Ri-

ver Yabe (TEMMINCK & SCHLEGEL); Lake Biwa (JORDAN & SNYDER); Lake Yogo, Mino; Lake Biwa, Matsubara, Karasaki; Tsuchiura; River Iwai, Ichinoseki; Nagoya; River Kika, Morioka (JORDAN & FOWLER); Far west Ôgaki city, Gifu Prefecture of Honshû, Shikoku, Kyûshû (OKADA & NAKAMURA); Tokiwa, Lake Biwa (TANAKA); Funayado, Kyûshû (JORDAN & FOWLER); Kumamoto (WAKIYA); Hamada (WAKIYA); Himeji (ABE); River, Katsura Kyôto (OKADA); River Kana and River Yabe, Fukuoka (OKADA). Lake Biwa; River Yodo; River Kino (TANAKA); Hyogo Prefecture (JORDAN & THOMPSON); Kagawa Prefecture (AOYAGI); River Shinano, Niigata Prefecture (TANAKA); Kumamoto Prefecture (JORDAN & THOMPSON).

Remarks: JORDAN and FOWLER[1] mentioned that the present species very similar to *Paracheilognathus rhombea* in a similar color pattern, with the addition of a black abdomen, and dark pectorals, and ventrals in some adults except with more elongate form. JORDAN and THOMPSON[2] marked the difference from all other species of its genus in Japan in having the greater depth of body, plain coloration and fewer number of scales in the lateral line.

39. Acheilognathus cyanostigma JORDAN et FOWLER.
"Ichimonji-tanago"
(PL. XXIII, figs. 1–3)

Acheilognathus cyanostigma JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., xxvi, pp. 820-822, fig. 2. – TANAKA, 1908, Ann. Zool. Jap., vii, part 1, p. 3. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, no. 4, pp. 221-222. – TANAKA, 1921, Nihon Gyogaku, p. 181. – UI, 1932, Kisyû Gyofu, p. 30. – OKADA, UCHIDA et MATSUBARA, 1935, Nihon Gyorui Zusetsu, p. 82, pl. 27, fig. 3. – MIYAZI, 1935, Kyôtofu Tansuigyo, p. 24, pl. 3, fig. 17. – OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, pp. 156–157, fig. 77.

Acheilognathus brevianals FOWLER, 1910, Proc. Ac. Nat. Sc. Phil., pp. 479-481. – TANAKA, 1921, Nihon Gyogaku, p. 182.

Acheilognathus lanceolata cyanostigma, NIWA, 1954, p. 277.

The original description[3] is follows:–

Acheilognathus cyanostigma JORDAN and FOWLER, new species.

Head, 4; depth, 3 1/16; D. III, 8; A. III, 8; p. 18; V. 8; scales, 39 in lateral line; 6 scales between origin of dorsal and lateral line, and 6 sales between the latter and middele of belly; pharyngeal teeth 5-5; width of head, 2 in its length; snout, 3 2/3 in head; eye, 4; interorbital space, 2 2/3; pectoral, 1½; ventral, 1 2/3.

Body moderately deep, and compressed. Head rather small, compressed; snout rather bluntly pointed and a trifle produced; eye small, anterior; mouth small, inferior; maxillary short, raching

1) JORDAN et FOWLER, 1903, p. 819.
2) JORDAN et THOMPSON, 1903, p. 223.
3) D. S. JORDAN and HENRY W. FOWLER, 1903: A Review of the Cyprinoid Fishes of Japan. Proc. U. S. Nat. Mus., vol. xxvi, pp. 820–822, fig. 2.

to the nostril and protractile; maxillary barbel very short; pharyngeal teeth smooth, and with a narrow grinding surface; nostrils close together and near the upper part of the eye; interorbital space rather broad, slightly elevated and flattened medianly. Gill-openings rather large; gill-rakers short, few, and weak; pseudobranchiae present.

Intestine with numerous convolutions. Peritoneum black.

Scales moderately large, cycloid, and some of them imbricated on the sides; no pectoral flap; ventral flap small.

Origin of dorsal about midway in the body without caudal, the anterior rays the highest, the base of the fin about 5 in body without caudal, and the upper edge of the fin nearly straight; origin of anal below the posterior dorsal rays or about midway between origin of ventral and base of last anal ray, the anterior rays the highest, the base of the fin about 5 in body without caudal, and the upper edge of the fin nearly straight; the base of the fin 1¾ in head the margin of the fin nearly straight; caudal deeply emarginate and the lobes pointed; pectorals reaching about two-thirds of the distance to origin of ventrals; ventrals inserted below the origin of the dorsal, and reaching the origin of the anal. Caudal peduncle rather long, a trifle shorter than head, and its least depth about 2½ in head. Leteral line slightly decurved and continued to the base of caudal.

Color in alchol, brownish above, pale beneath; dorsal and caudal grayish black, the former with several darker longitudinal cross bars; anal greyish, with a broad marginal, whitish band; pectorals grayish; ventrals grayish black; snout dark brown; sides with a longitudinal, blackish band beginning abruptly in a black spot on the upper part of the sides about over the middle of the pectoral, and on the sixth scale from the head; no dark spot above gill openning.

Length, 2¾ inches.

Type No., 7724, Inchthyological, Collections Leland Stanford Junior University Museum. Cotypes are in the United States National Museum. Locality, Lake Biwa at Matsubara in Ômi.

We have many specimens of this species from Lake Biwa at Matsubara and its tributary, Lake Yogo in Mino. It is distinguished chiefly by the dark, distinct, and nearly uniform lateral stripe beginning on the sixth scale from the head in a dusky bluish spot. In young specimens, the character is readilly seen, and they are easily separated from the young of other species.

Description: Head, 4; depth 3.3 in body length to base of caudal; D. III, 8; A. III, 8 or 9; P. 16; V. 8; scales in lateral line 38 in transverse series between the insertions of vertical fins $^{6}/_{4}$; pharyngeal teeth 5–5; width of head, 2 in its length; snout 3.7 in head; eye, 4; anterior edge of premaxillaries level with lower edge of pupil.

Body somewhat deep, and compressed. Head rather small, compressed; snout bluntly pointed and a trifle produced; eye small, anterior; mouth small, horizontal; maxillary short, reaching to the norstril and protractile; maxillary barbel very short, nearly obsolete, but present as a knob on end of maxillary; pharyngeal teeth hooked, plicate on lower surfaces, usually a narrow grinding surface; nostrils close together and near the upper part of the eye; interorbital scace rather broad, slightly elevated and flattened medianly. Gill-openings rather large; gill rakers, 2 + 8, longest at angle, short and thick; pseudobranchiae present.

Intestine with numerous convolutions. Peritoneum black. Scales moderately large, cycloid, and some of them imbricated on the sides; no pectoral flap; ventral flap small.

Dorsal fin inserted nearly midway between snout and base of caudal, its base 1.5 in head, its height 1.5; the anterior rays the highest, the base of the fin about 5 in body without caudal, and the upper edge of the fin nearly straight; anal fin inserted under sixth branched ray of dorsal fin, its base 2 in head, its height 1.66; its margin straight;

the anterior rays the heighest, the base of the fin about 5 in body without caudal; pectoral 2 in body depth, the ventral fin equal to the pectoral fin, inserted below the origin of dorsal; caudal fin deeply emarginate and the lobes pointed. Caudal peduncle slightly longer than usual, 4 in body length, its depth 10 in body length.

Lateral line slightly decurved and complete.

Table 43. Measurements of *Acheilognathus cyanostigma* (JORDAN et FOWLER).

Collection	Fish. Mie Univ.*				
Total length	71.0mm.	68.0mm.	55.0mm.	79.0mm.	52.0mm.
Body length	59.7	56.8	45.5	66.0	42.0
Body length/Head	3.98	4.45	4.15	4.20	3.96
Body length/Depth	3.32	3.48	3.37	3.26	3.84
Body length/Predorsal length	1.97	2.10	2.12	2.10	2.00
Body length/Prepectoral length	4.21	4.37	4.13	4.13	4.20
Body length/Preventral length	2.10	2.10	2.16	2.20	2.33
Body length/Preanal length	1.55	1.58	1.68	1.65	1.65
Head/Snout	3.70	3.12	3.67	3.34	3.78
Head/Upper jaw	5.70	6.40	6.10	5.23	5.90
Head/Interorbital width	2.69	2.56	2.39	2.53	3.22
Head/Diameter of Eye	4.10	3.76	3.44	4.13	3.79
Head/Length of Caudal peduncle	0.98	0.85	0.92	0.92	0.94
Head/Depth of Caudal peduncle	2.32	2.13	2.30	2.15	2.52
Head/Length of Dorsal fin	1.48	1.33	1.57	1.40	1.63
Head/Length of Anal fin	1.85	1.71	1.97	1.71	2.00
Head/Height of Dorsal fin	1.57	1.47	1.30	1.57	1.45
Head/Height of Anal fin	1.64	1.62	1.75	1.69	1.71
Head/Pectoral length	1.59	1.49	1.53	1.57	1.64
Head/Ventral length	1.74	1.78	1.74	1.85	2.00
Date	27, V, 1955				
Locality	Lake Biwa, Shiga Prefecture				

* Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture

Color in alcohol plain, save for the lateral stripe of blue black originating the width of a scale above the fifth or sixth scale of lateral line in a black spot as large as pupil and continued parallel to line of back to center of caudal, not reaching caudal fin; the anterior end of band frequently faint and the initial spot small; no shoulder spot; dorsal and caudal grayish black, the former with several darker longitudinal cross bars; anal greyish, with a broad marginal whitish band; ventrals and pectorals clear, the former occasionally greyish black.

Secondary sexual characters: In general, male is larger than female. The lateral longitudinal stripe of the female is not broader than that of the male and extremely narrow at the anterior end, scarcely connecting with an indistinct bluish green spot. A pair of large pearl organ discs appear on the male snout and the other pearl organs appear on the internasal space, just front of eye, and orbital margin. In the sexual season, the male shows a distinct nuptial color, deep black on the throat, belly, dorsal and anal fins. The white stripes of the dorsal and anal fins change the color into purplish red. The ovipositor is moderately long, light grey, measuring 35–43 mm.

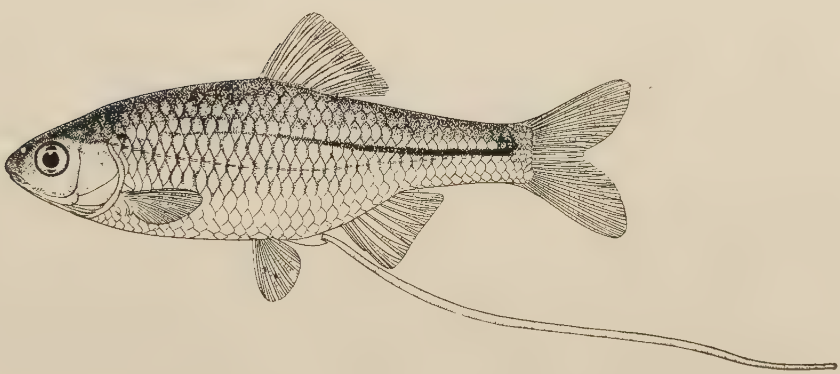
PLATE XXIII



1



2



3

1. ***Acheilognathus cyanostigma*** JORDAN et FOWLER, Lake Biwa. ♂ ×1
2. ***Acheilognathus cyanostigma*** JORDAN et FOWLER, Lake Biwa. ♀ ×1.5
3. ***Acheilognathus cyanostigma*** JORDAN et FOWLER, Lake Biwa. ♀ ×1.5

Habits: This species is mostly found in still water of lakes and swamps. The breeding season occurs in spring, depositing long elliptical eggs in freshwater mussels as *Unio douglasiae nipponenis* and *Anodonta japonica.*

Distribution: Lake Bia, Matsubara (JORDAN & FOWLER); Lake Yogo, Mino (JORDAN & FOWLER). Lake Biwa, Matsubara (JORDAN & THOMPSON); Lake Mikawa, Fukui; Lake Biwa, Ôtsu (JORDAN & KAWAMURA); Ogaki, Gifu prefecture; River Yodo (OKADA & NAKAMURA); River, Kino Wakayama Prefecture (UI); River, Katsura Kusemura, Kyoto (OKADA); Okayama city (OKADA); Omiya, Saitama Prefecture (AOYAGI); River Kiso (JORDAN & FOWLER, NIWA); River Kino (UI, TANAKA); Lake Biwa; River Yodo (JORDAN, FOWLER, MIYADI); Mikata Lake, Fukui Prefecture (JORDAN, HUBBS); River Chikugo (AOYAGI).

Remarks: In 1910, FOWLER described a new species *Acheilognathus brevianalis* from a specimen collected at Matsubara of Lake Biwa. He mentioned that the present species differs only in the coloration from *A. cyanostigma.* From the observation of many specimens of the present species collected at Lake Biwa, we could not find the different character of the *A. brevianalis* and the female of the present species. From this point we would include the *A. brevianalis* into the female of the present species. He also established a new subgenus *Rhodeus* in the type of *Ach. brevianalis*, differing in the absence of maxillary barbels from the subgenus *Acheilognathus* BLEEKER. But it is not need to recognize the present new subgenus as the absence of maxillary barbels is not so important character in the present genus *Acheilognathus.*

Genus **Tanakia** JORDAN et THOMPSON, 1914.

JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. 6, no. 4, pp. 230–231, fig. 6.
Type ………………**Rhodeus orizae** JORDAN et SEALE
Type locality ……Kawatana, north west of Nagasaki

Characters: Body deep, compressed; mouth small, maxillary not reaching eye; a short barbel at its tip; dorsal and anal of about twelve rays, the first two unbranched; pharyngeal teeth 5–5, smooth, hooked at tip; gill-rakers very short; lateral line incomplete, but marked posteriorly by modifications of a lateral scales; peritoneum black; intestine elongate. Freshwater fishes of small size, about one or two centimeters in length.

Key to the Japanese species of Tanakia

a[1] Lateral line incomplete, sloping; pores opened on entire scales; scales 32 in longitudinal; barbels rather short. ………………………… **T. orizae**
a[2] Lateral line incomplete; pores restricted to anterior scales; scales 36 in longitudinal; barbels equal in length to half diameter of eye. ………………………… **T. tanago**

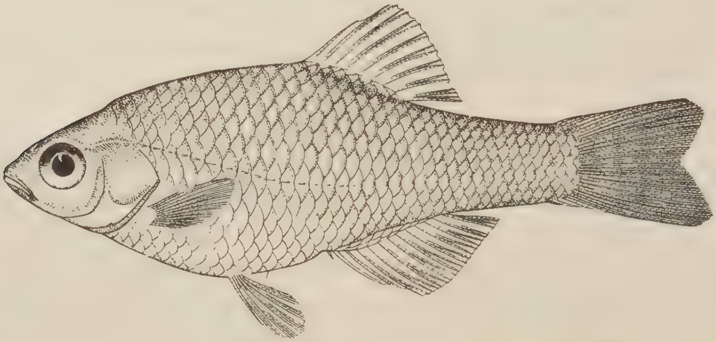
40. **Tanakia orizae** (JORDAN et SEALE).

"Azetanago"

(Text-fig. 65)

Rhodeus orizae JORDAN et SEALE, 1906, Proc. Unit. Stat. Mus., vol. 30, pp. 144-145.

Tanakia orizae JORDAN es THOMPSON, 1914, Mem. Carn. Mus., vol. 6, no. 4, pp. 230-231, figs. 6. – TANAKA, 1921, Nihon Gyogaku, p. 179.



Text-fig. 65. ***Tanakia orizae*** (JORDAN et SEALE). × 5/3

The original description* is as follows:

Head, 3.75 in length (without caudal); depth, 2.50; eye, 2.75 in head; D. 10; A. 12; pharyngeal teeth, 5, hooked; scales, 11-32; lateral line sloping downward to above or somewhat behind ventrals, where it ceases.

Body deep, compressed; snout short, shorter than eye, which is equal to interorbital width; mouth small, the maxillary not reaching front of eye, its tip with a distinct barbel; scales firm; front of dorsal nearer snout than base of caudal; ventrals below tip of pectoral, which is 1.35 in head; caudal about equal to head.

Color, in spirits, yellowish; the margins of the scale above, slightly darker; a dark stripe from nuchal region to front of dorsal; a golden shade on opercle; fins yellowish, unmarked.

Seven specimens, the largest an inch long, were taken in a ditch in a rice field at Kawatana, northwest of Nagasaki, in the island of Kiusiu, in Japan. It is found in company with the small *Cyprinodont*, *Aplochielus latipes*, which it somewhat resembles. This species is related to the Chinese *Rhodeus ocellatus*, and both seem to belong to the European genus, *Rhodeus*.

Type. - Cat. No. 53412, U. S. N. M.

Cotypes. - No. 9258, Stanford University.

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* In the original descriptions of the present genus *Tanakia*, JORDAN and THOMPSON mentioned as follows.

"An examination of the type of *Rhodeus orizae*, at present in the collection of Stanford University, shows the lateral line to be apparently lacking posteriorly, although the scales are modified throughout in a continuous series. The tip of each scale is emarginate and a groove lies along the center of the scale where the tube should lie. This species, with *Rhodeus miobuta* TANAKA, has barbels as in *Acheilognathus*. *Rhodeus orizae* may be taken as the type of a new genus *Tanakia*, separated from *Rhodeus* by the presence of barbel. It is named for SHIGEO TANAKA, the accomplished ichthyologist of the Imperial University of Tôkyô.

41. **Tanakia tanago** TANAKA.

"Miyako tanago, Miyobuta"

(Text-fig. 66)

Rhodeus miobuta TANAKA, 1909, Journ. Coll. Sci. Tôkyô, xxvii, Art. 8, p. 12. – TANAKA, 1911, Fishes of Japan, pp. 3-4, pl. 1, fig. 4. – JORDAN, TANAKA, SNYDER, 1913, Cat. Fish. Japan, p. 74.

Tanakia tanago 1921, TANAKA, Nihon Gyogaku, p. 179. – OKADA et NAKAMURA, 1948, Nihon no Tansuigyorui, pp. 151–152, fig. 71.

Rhodeus tanago TANAKA, 1911, Journ. Coll. Sci. Tôkyô, xxvii, art. 8, p. 10. – JORDAN, TANAKA, & SNYDER, 1913, Cat. Fish. Japan, p. 74.

Tanakia miobuta TANAKA, 1921, Nihon Gyogaku, p. 179. (Type locality … A pond in the Botanical Garden at the Imperial University of Tôkyô).

The original descriptions is as follows:

Rhodeus miobuta TANAKA**

Plate I, fig. 4. Myobuta.

Rhodeus miobuta TANAKA, Journ. Coll. Sci. Tôkyô, xxvii, Art. 8, Oct. 10, 1909, p. 12; Obama, Prov. Kadsusa, Type No. 1860, Sci. Coll. Mus. Tôkyô.

Habitat. – Fresh-water; Obama, Prov. Kadsusa; Ashikaga, Prov. Shimotsuke.

Head 4, depth 2¾ in total length measured to root of middle caudal rays. Eye 3⅕, interorbital 2¾, snout 3⅜ in head. D. II, 8; A. II, 9; P. 12 or 13; V. 7; scales in longitudinal series 36; in transverse series 11.

Body oblong compressed; head also compressed; interorbital broadly convex; nostrilis close together; anterior nostril with a flap on posterior edge. Mouth horizontal; maxillary scarcely extending to anterior rim of eye, its barbel equal in length to half diameter of eye. Dorsal inserted midway between tip of snout and root of middle caudal rays; anal inserted below seventh ray of dorsal. Caudal emarginate. Scales large, cycloid. Lateral line incomplete; pores restricted to anterior scales.

Color in formalin brownish, with darker edge to each scale, pale below. A brown shoulder spot distinct. A longitudinal stripe on top of back before dorsal fin. Both dorsal and anal grayish brown, with black margin; pectoral and ventral dusky, the latter with black tip; caudal brownish.

Described and figured from the type specimen, 55 mm. long as measured to tip of caudal, taken at Obame, Prov. Kadsusa, by Mr. SUZUKI, No 1860, Science College Museum. Tôkyô.



Text-fig. 66. ***Tanakia Tanago*** TANAKA

* JORDAN et SEALE, 1906, Proc. Univ. Stat. Nat. Mus., vol. xxx, pp. 144–145.

**SHIGEHO, TANAKA, 1935 (1911–1914): *Rhodeus miobuta* TANAKA (Cyprinidae). Figures and Descriptions of the Fishes of Japan, pp. 3-4, pl. I, fig. 4.

Table 44. Measurements of *Tanakia tanago* (TANAKA).

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total length	45.0mm.	Head/Interorbital width	2.20mm.
Body length	36.0	Head/Diameter of Eye	3.66
Body length/Head	3.06	Head/Length of Caudal peduncle	1.11
Body length/Depth	3.62	Head/Depth of Caudal peduncle	2.20
Body length/Predorsal length	1.16	Head/Length of Dorsal fin	1.57
Body length/Prepectoral length	3.27	Head/Length of Anal fin	1.57
Body length/Preventral length	1.87	Head/Height of Dorsal fin	1.22
Body length/Preanal length	1.63	Head/Height of Anal fin	1.84
Head/Snout	3.66	Head/Pectoral length	1.37
Head/Upper jaw	2.20	Head/Ventral length	1.57
Date	V. 1958		
Locality	Lake Biwa, Shiga Prefecture		

* Ôtsu Hydrobiological Station at Ôtsu, attached to Kyôto University.

Distribution: Obama, Prov. Kadsusa (TANAKA, JORDAN, SNYDER); Tôkyô (TANAKA, JORDAN, SNYDER); Pond of Botanical Garden, Imperial University of Tôkyô Kantô district (OKADA & NAKAMURA);

Genus Rhodeus AGASSIZ, 1835.

Rhodeus AGASSIZ, 1835, Mém. Soc. Sci. Nat. Neuchatel, l, p. 37.

Characters: Body laterally compressed, deep, small; head small and compressed. Mouth terminal, arched, without barbels; upper jaw protractile, lower jaw without labial fold. Pharyngeal teeth 5–5, arranged in one row, compressed, not denticulated, the bevelled surface with a simple groove. Gill-rakers very short, not fused. Eye placed in or above the axis of the body. Gill membranes attached to the isthmus. Alimentary canal very long, about five times of the total length of body; peritoneum blackish brown. Scale large, lateral line incomplete, only on the anterior part of the body. No scaleless keel before anal fin. Dorsal fin with from 9 to 12 branched rays, extending from the ventrals to beyond the origin of the anal, without spines. Origin of anal anterior to the vertical from the end of the dorsal base. Anal fin rather elongate with branched rays, 8 to 14; caudal deeply bifurcate.

Male, during the spawning season, with pearl organs on the snout, and the female with a long external ovipositor for the deposition of egg in the branchial chamber of Unionid bivalves.

42. Rhodeus ocellatus ocellatus (KNER).

"Baratanago"

(PL. XXIV, figs, 1–15; Text-figs. 67, a–b)

Pseudoperilampus ? ocellatus KNER, 1867, Reise "Novara", Zool. 1, Fische, p. 365, pl. xv, fig. 6.
Rhodeus wangkinfui WU, 1930, Sinensia, i, p. 77, fig. 5.

Pseudoperilampus lighti Wu, 1931, Contrib. Biol. Lab. Sci. Soc. China, (Zool. Ser.) vii, p. 25, fig. 4.
Pseudoperilampus ocellatus Nichols, 1943, Freshwater Fishes of China, p. 153.
Rhodeus ocellatus Günther, 1868, Cat. Fish. Brit. Mus., vol. 7, p. 280. -Okada et Nakamura, 1948, Nihon no Tansui Gyorui, pp. 149–150, fig. 69.

The original description* is as follows:

Art **Pseudoperilampus** ? **ocellatus** n.
Taf. xv, Fig. 6.

D. 13, A. 13, V. 7, P. 10 ...... Squ. long. 33–34, transv. 10–11.

Höhe bei Beginn der Dorsal nahezu 1/2 Körperlänge, der kleine Kopf sufolge des vom Vorderrücken sehr gewölbt ansteigenden Profiles, nur wie ein kurzes, stumpfspitzes Dreieck vortretend; seine Höhe am Hinterhaupte kleiner als seine Länge, obwohl auch diese nicht die halbe Körperhöhe beträgt und 4½ mal in seiner Länge enthalten ist und der Caudallänge fast gleichkommt. Das Auge misst 1/3 Kopf-länge und steht von Schnauzenrande weniger als 1 Diameter, von anderen Auge aber 1⅓ entfernt. Die gewölbte Schnauze ist bis zum Supra-und Suborbitalringe porös, die beiden Narinen sind gross. Die Dorsale beginnt in halber Körperlänge. ihr zweiter Strahl, der um 1/3 länger als der erste ist, ist der längste der Flosse, fast so stark wie ein Knochenstrahl, aber am der Spitze deutlich gegliedert; er erreicht die Kopfhöhe und übertrifft die der Anale, welche erst unter ihrer Mitte beginnt. (In der Figur beginnt sie zu weit vorne.) Die Ventralen sind weit vor halber Körperlänge eingelenkt und gleichweit vom Ende der Anale entfernt. Die Pectoralen reichen bis zu ihnen und sie bis zum After zurück. Die dünnen Schuppen sind ungleich gross, in halber Höhe der Seiten viel grösserals gegen den Rücken und Bauch; am Schwanze werden sie zugleich viel höher als lang und in Structur mehr denen von Clupeen als Cyprinen ähnlich, indem die Radien auf der freien Fläche nicht sowohl strahlig auslaufen, sondern vielmehr nach auf- und abwärts. Der Seitencanal mündet nur an den ersten fünf Schuppen hinter dem Schultergürtel mit Röhrchen, bricht dann ab und tritt nie mehr vor, obwohl man seinen Verlauf am Schwanze unter den Schuppen durchschimmern sieht. - Wie in Grösse und Gestalt erinnert diese Gattung auch an Färbung an unseren *Rhodeus*, indem jederseits am Schwanze ein stahlblauer Längesstrich auffällt, der von einer nach vorne stärkeren und, breiteren Silberbinde begleitet wird und bald erlischt; hinter dem Schultergürtel glänzt ein goldiger Augenfleck, der vorne und ruckwärts stahlblau eingesäumt its; die Dorsale zeigt längs halber Höhe eine Reihe dunkler Flecken, die Anale einen schmalen dunklen Saum[1]. – Die Schwimmblase des kleinen Unicum von 2″ 5‴ Länge wurde nicht untersucht. – Von Schanghai.

Description: Body depressed, deep, the height of body contained twice and one-third in total length; head pointed bilaterally depressed, length of head four times and a half; snout blutly pointed. Eye moderately large, somewhat anteriorly and dorsally situated; interorbital somewhat broad, slightly raised; nostrils near the orbit, anterior orbit with short tube, like skin fold along the margin; internasal space flat. Mouth small, oblique, opened under the snout; lower jaw somewhat shorter than upper jaw; lips thin, smooth, somewhat strong along the margin, without barbels; posterior end of upper jaw reached anterior nostril or anterior margin of posterial nostril. Gill slit lateral, broad; gill membrane united. Pharyngeal teeth 5–5, arranged in one low; lateral smooth. Alimentary canal very long, about five times of entire body length. Anus opened somewhat posteriorly at the base of ventral fin. Air bladder large, occu-

*Rudolf Kner, 1865, Reise der Osterreichischen fregatte Novara um die Erde in der Jahren 1857, 1858, 1859 unter den befehlen des Commodore B. Von Wullerstorf Urbair Zoologischer Theil Zeweite Band. Fische. p. 365, tab. xv, fig. 6.

pied along dorsal part of body cavity, with small anterior and large posterior chambers. Peritoneum dark brown.

Scale large, somewhat rhomboidal. Origin of dorsal fin in middle of body; the distance between dorsal and snout equal to the distance between origin of dorsal fin and posterior end of caudal peduncle; the base of dorsal fin longer than length of head. The first ray of dorsal fin unbranched, very short, about half lengths of the second and third rays; the third unbranched; nearly as long as the height of fin, soft and flagelated at the end. Caudal fin deeply bifurcated, upper and lower lobes bluntly pointed at ends. The origin of anal fin situated below the base of 4th and 5th rays of dorsal, small, the posterior end reached far posteriorly the posterior end of dorsal fin. The origin of ventral fin somewhat anteriorly than origin of dorsal fin. Pectoral fin. small, somewhat narrower.

Lateral line incomplete; 1–7 scales on the anterior part of body, running from upper end of gill slit. Coloration nearly uniform, light brown on dorsal, lighter on lateral,



Text-figs. 67. a. ***Rhodeus ocellatus ocellatus*** (Kner). ♀ ×1
b. ***Rhodeus ocellatus ocellatus*** (Kner). ♂ ×1

with blue black longitudinal band along the middle of body. Male is longer and higher than the female and has a dark spot, as large as pupil.

Secondary sexual character: In the breeding season, the male shows a beautiful nuptial color and pearl organs on the body. A pair of the pearl organ discs on the snout and a distinct group of the pearl organs on the upper margin of orbit, the margin of nostril and the anterior part of eye, are exhibited.

Table 45. Measurements of *Rhodeus ocellatus ocellatus* (KNER).

Collection	Fish. Mie Univ.*			O. H. B. S. **	
Total length	53.5mm.	56.4mm.	55.0mm.	60.0mm.	50.0mm.
Body length	41.5	43.8	43.5	41.0	39.0
Body length/Head	4.15	4.25	4.10	3.72	3.90
Body length/Depth	2.08	2.11	2.09	2.40	2.50
Body length/Predorsal length	2.08	1.99	1.98	1.86	1.95
Body length/Prepectoral length	4.37	4.38	4.07	3.72	3.90
Body length/Preventral length	2.31	2.09	2.29	2.16	2.50
Body length/Preanal length	1.63	1.57	1.74	1.71	1.62
Head/Snout	3.33	3.42	3.53	3.67	3.33
Head/Upper jaw	5.55	4.68	4.92	2.75	3.33
Head/Interorbital width	2.50	2.58	2.50	2.75	2.50
Head/Diameter of Eye	3.13	3.12	3.12	3.67	3.33
Head/Length of Caudal peduncle	1.12	1.29	1.01	1.00	1.25
Head/Depth of Caudal peduncle	1.89	1.87	2.00	1.83	2.00
Head/Length of Dorsal fin	0.98	0.81	0.86	1.00	1.00
Head/Length of Anal fin	1.00	0.98	0.95	1.10	0.91
Head/Height of Dorsal fin	1.00	1.03	1.18	1.37	1.25
Head/Height of Anal fin	1.34	1.39	1.58	1.37	1.25
Head/Pectoral length	1.26	1.29	1.41	1.24	1.25
Head/Ventral length	1.74	1.81	1.56	1.57	1.43
Date	VIII, 1955			V, 1923	
Locality	River Chikugo, Kyûshû			Lake Biwa	

* Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

** Ôtsu Hydrobiological Station, attached to Kyôto University.

Female has a long ovipositor in the breeding season and grows as long as the body length.

Habits and Development: The present species are found mostly in slow current shallow waters of river and stream or muddy swamps and ponds with dense vegetation of *Vallisneria* and *Hydrilla.* In the breeding season, they are swimming in school. They feed on micro-animal and plant foods and breed during May and June. One year after hatching out, the female deposits 32–39 eggs in the gill chambers of *Unio douglasiae nipponensis* or *Anodonta japonica.* The deposition of eggs is carried out several times. Eggs are nearly ovoidal with a somewhat narrower neck-like end, measured 1.1–1.4 × 2–25. mm. in size, yellow, untranspalent. Hatching out larvae spend in the branchial chamber of vivalve a short while and when grown up 8 mm. long, they leave the vivalve. Pre-larval stage: Larva found in the branchial chamber of mussel, measured 2.3 mm. in total length and 2.1 mm. in yolk length. The anterior end of larva covered the entire margin of yolk sac provided with a pair of distinct ridge. The larva measured

2.6 mm. in body length and 2.5 mm. in yolk length, extended posteriorly together with body and yolk sac; the ridge developed more prominent as a projection extending posteriorly on both lateral sides.

The larva with 4.2 mm. body length and 3.0 mm. yolk length provided well developed head and anus.

The larva with 5.1 mm. body length, 2.8 mm. yolk length and 18+13=31 myomeres has unopened mouth and well-developed broad fin membrane on the posterior half of body and very minute spinous tubercles on the entire surface of the body. Black chromatophores appear on the eye.

The larva with 6.6 mm. body length, 2.8 mm. yolk length and 32 myomeres has a triangular broad opened mouth and black eye. Lower jaw and pectoral fin somewhat developed and dorsal and caudal fins appear. Melanophores appear on head, dorsal side of body and caudal fin.

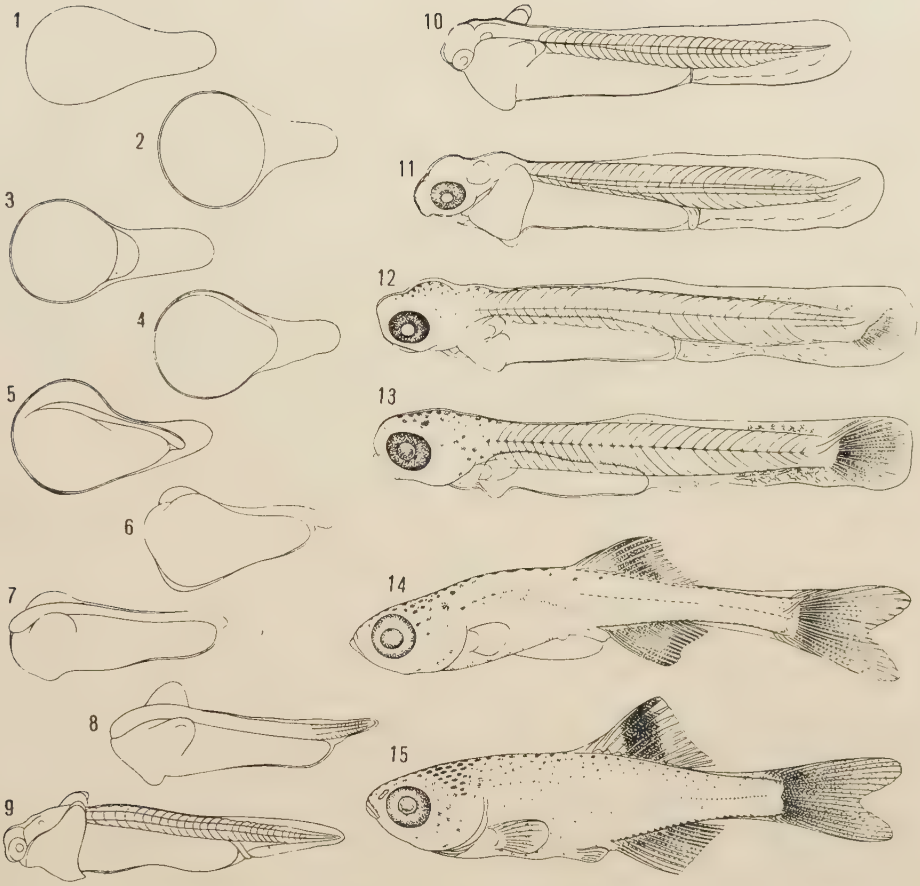
Post-larval stage: Larva extruded from the mussel, and in free living stage is called post-larval stage. The larva with 7.7 mm. body length (Body length 6.3 mm., trunk length 3.6 mm. body height 1.2 mm., Dorsal fin II, 11, and anal fin II, 10, myomeres 16+16=32). This just extruding larva with very small ventral fin. Melanophores somewhat fewer on lateral side, and few along the below of the dorsal fin. Large melanophores on the ventral side of trunk.

Table 46. Measurements of *Rhodeus ocellatus ocellatus** (Kner).

NO.	Date	Local	Sex	T.L.	N.D.	N.A.	N.S.	N.V.	B.L./B.H.	B.L./H.L.	H.L./S.L.	H.L./E.D.	H.L./I.O.	H.L./C.L.	C.L./C.H.	H.L./C.H.	N.T.	B.R.
1.	VI 25, '35	Shonei Korea	♂	36.0	III,11	III,10	31	32	2.4	3.3	3.2	3.2	2.2	1.6	1.3	2.2	5-5	
2.	——	——	♀	39.0	III,12	III,11	31		2.6	3.7	3.2	3.2	2.2	1.6	1.2	2.0		9+16=25 (interior) 3+8=1 (posterior)
3.	——	——	♀	40.0	III,12	III,11	32		2.5	3.5	3.4	3.4	2.4	1.7	1.2	2.1		
4.	V 24–28'36	——	♂	42.0	III,11	III,10	31		2.4	3.7	3.1	3.4	2.2	1.4	1.3	1.8		
5.	VI 25, '35	——	♀	43.5	III,12	III,11	31		2.4	3.8	3.3	3.0	2.1	1.5	1.3	2.1		
6.	——	——	♀	49.0	III,10	III,11	31	32	2.5	3.8	3.8	2.8	2.4	1.3	1.8	2.5	5-5	8+20=28 2+8=10
7.	V 24, '34	——	♂	52.0	III,11	III,10	32		2.3	4.0	3.2	3.2	2.5	1.4	1.4	2.0		
8.	V 24–28'36	——	♂	57.5	III,11	III,10	33	33	2.2	4.1	2.7	3.4	2.2	1.4	1.2	1.8	5-5	7+20=27 2+10=12
9.	VIII 24, '23	Indo River	♂	87.0	III,11	III,10	32		1.6	4.0	3.5	4.1		1.2	1.6	2.0		

T.L…Total length; N.D…Number of Dorsal fin rays; N.A…Number of Anal fin ray; N.S…Number of scale; N.V…Number of vertebrae; B.L…Body length; B.H…Body height; H.L…Head length; S.L…Snout length; E.D…Eye diameter; I.O…Interorbital space; C.L…Length of caudal peduncle; C.H…Height of caudal peduncle; N.T…Number of pharyngeal teeth; B.R…Number of branchial rays.

* These measurements made by K. Uchida in Korean specimens.



Development of ***Rhodeus ocellatus ocellatus*** (KNER), after KEITARO UCHIDA.

1. Ripened egg in ovary 2.4 × 1.2 mm. in size.
2. Spawned egg 2.4 × 1.5 mm. in size.
3. Morula stage 2.5 × 1.3 mm.
4. Embryo formation 2.2 × 1.4 mm.
5. Embryo just before hatched 2.4 × 1.4 mm. in total length.
6. Larva just hatching 2.3 × 1.3 mm. in total length.
7. Larva measured 2.6 mm. in total length.
8. Larva measured 3.2 mm. in body length.
9. Larva measured 4.2 mm. in body length.
10. Larva measured 5.1 mm. in body length.
11. Larva measured 5.8 mm. in body length.
12. Larva measured 6.0 mm. in body length.
13. Larva measured 6.5 mm. in body length.

14-15. Juveniles 7.7-11. mm. of body length.

Juvenile with 11 mm. body length and with 2.0 mm. body height (Dorsal fin III + 12; Anal III + 11) has black pattern spreading obliquely from the upper margin of the fin through the middle of the anterior part of the fin to the middle of the base. This pattern changes the orientation gradually into the anterior part of dorsal fin and remains in female but disappears in male as age advances. In the life, white pigment appears just front of the melanophore of the dorsal fin.

Distribution: Lake Biwa, River Yodo (MIYADI); Ogura pond, Kyôto-fu (AOYAGI); River Chikugo; River Yabe, Kumamoto Prefecture (JORDAN & THOMPSON); Kumamoto Prefecture (JORDAN & HUBBS); Korea (MORI); Formosa; South China.

Remarks: In 1935, T. MORI[1)] has reported that *Rhodeus kurumeus* JORDAN et THOMPSON found in Chikugo river, Kyûshû may be identified with the present species distributed in Korea. D. MIYADI[2)] described *Rhodeus smithi* (REGAN) from the freshwater fishes in Kyôto district and mentioned that is similar to *Rhodeus kurumeus*. K. UCHIDA[3)] also noted that both *Rhodeus kurumeus* and *Rhodeus smithi* may be included under the present species *Rhodeus ocellatus* (KNER).

Genus Acanthorhodeus BLEEKER, 1870.

Acantohrhodeus BLEEKER, 1870, Verslag. Aka d. Wetensch., Amsterdam, Afd. Natuurk., (2), p. 253.

Type: **Acanthorhodeus macropterus** BLEEKER.

Characters: Body small, depressed, deep. Mouth small, terminal, lips thin, soft with a pair of short barbels or not, upper jaw protractile. Pharyngeal teeth in one row, serrate. Eye placed in or above the axis of the body. Alimentary canal long, peritoneum blackish brown. Scale large; lateral line complete, shallowly curved. Base of dorsal fin and anal fin somewhat long; origin of anal anterior to the vertical from the end of the dorsal base. Dorsal and anal fins with spinous rays. Caudal fin deeply bifurcated. Anal branched rays, 8 to 14; dorsal, 11 to 18. No scaleless keel before anal fin. No serrate, spinous ray in the anal. Gill membranes attached to the isthmus. Gill rakers not fused.

Key to the Japanese species of Acanthorhodeus

a.[1] Lateral color band as broad as pupil, not pointed posteriorly. Lateral line absent. No large spot on dorsal. .... **Ac. atremius**

a[2]. Lateral color band very narrow, about less than half width of pupil. Lateral line present in first four scales. A large black spot anteriorly on dorsal. .... **Ac. sciosemus**

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1) MORI, T. 1935, Zool. Mag., 47 (562-563), pp. 560-561.
2) MIYADI, D. 1935, Kyotofu Shisekimeisho Tennenkinenbutsu Chosa Hôkoku, vol. 16, pp. 24-25.
3) UCHIDA, K. 1939, Chosen Gyoruishi, p. 90.

43. **Acanthorhodeus atremius** JORDAN et THOMPSON.

"Kazetogetanago"

(Text-figs. 68. a–b)

Acanthorhodeus atremius JORDAN et THOMPSON 1914, Mem. Carnegie Museum, vol. 6, no. 4, pp. 227–228, pl. 25, fig. 3. – TANAKA, 1921, Nihon Gyogaku, pp. 177–178. – OKADA et NAKAMURA, 1948, Nihon no Tansui Gyorui, pp. 150–151, fig. 70.



a



b

Text-figs. 68. a. ***Acanthorhodeus atremius*** JORDAN et THOMPSON. ♂ ×1
b. ***Acanthorhodeus atremius*** JORDAN et THOMPSON. ♂ ca. ×1.5

The original description* is as follows:

Acanthorhodeus atremius sp. nov.

The genus *Acanthorhodeus* BLEEKER is separated from *Rhodeus* by the development of one of the rudimentary rays of the dorsal as a distinct spine. The Chinese species of the genus are large fishes, shaply separable from *Rhodeus*, but the Japanese species of *Acanthorhodeus* are scarsely distinct from the other genus. This may make the mergence of the two groups nesessary.

Described from two specimens collected by JORDAN et SNYDER in the Chikugo River at Kurume in 1900; both males, 4.5 and 5 cm. in total length; type in the Stanford University Collection; cotype in the Carnegie Museum.

Head 4 in body -length; depth 2.4; eye 2.66 in head; snout 4; length of caudal peduncle from last anal rays 1.25 in head, its depth 2; dorsal height 1.25; dorsal base 1.125; anal height 1.5, its base 1.2;

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* JORDAN, D. S. et THOMPSON, W. F., 1914, Mem. Carnegie Museum, vol. 6, no. 4, pp. 227–228, pl. 25, fig. 3.

D. rays II, 10; A. II, 9 or 10; pharyngeal teeth 5–5; scales in lateral series, 32, in transverse series between insertions of vertical fins 11, between occiput and dorsal 16.

Snout not overhanging premaxillaries, its tip level with lower half of pupil; maxillaries not quite reaching anterior border of orbit; mouth not very oblique; male with tubercular prominences on snout widely separated and protuberant; a small tuberculated area above and between eye and nostril; no barbels present; pharyngeal teeth hooked, with narrow grinding surface occasionally plicate on the lower side as in *Acheilognathus rhombeus*; gill-rakers short, 3+6.

Dorsal inserted midway between snout and base of caudal, its third, or first branched ray extending beyond base of last; second ray somewhat spine-like and strong, its length two-thirds that of succeeding ray; first spine three-fifths of second; outline of fin straight, last, ray nearly as long as third; anal similar, save that its spine is three-quarters of the length of the succeeding ray, its insertion under fourth branched ray of dorsal; its third ray, when spine, extending beyond base of its last ray; pectorals reaching beyond base of ventrals, their length 1.2 in head; ventrals reaching insertion of anal, length slightly less that of pectorals. Lateral line continued horizontally, only through first four scales, its lateral series of scales then dropping sharply towards ventral line of body.

Color-pattern that of *Achilognathus*, a lateral blue-black stripe, widest posteriorly where in nearly equals diameter of pupil, and ending abruptly; anteriorly the stripe narrows, vanishing two or three scales front of dorsal; an indefinite shoulder-spot just behind angle of gill-opening, succeeded by a silvery area two scales wide, another indefinite spot behind this, the whole sligtly larger than eye; line of back very dark; belly pigmented, as is usual in males of this group; dorsal anteriorly margined with white, posteriorly tipped with black; remainder of fin dusky, with two faint narrow longitudinal stripes about the middle; anal similar but with white margin continued posteriorly proximal to black tips of rays, stripes on fin very indistinct, pectorals and ventrals without pattern, latter dark, as is the belly.

This species may be easily distinguished by the broad lateral band of blue-black and the white margined anal, besides by the depth and the pharyngeal teeth.

44. Acanthorhodeus sciosemus JORDAN et THOMPSON.

"Kumotoge-tanago"

(Text-fig. 69)

Acanthorhodeus sciosemus JORDAN et THOMPSON, 1914, Mem. Carnegie Museum, vol. 6, no. 4, pp. 228–229, pl. xxvi, fig. 1. – TANAKA, 1921, Nihon Gyogaku, p. 178.



Text-fig. 69. ***Acanthorhodeus sciosemus*** JORDAN et THOMPSON. ca × 1.2

The original description* is as follows:

Acanthorhodeus sciosemus JORDAN et THOMPSON

Described from six females and three males, the longest 4cm. in total length, from Chikugo, collected by JORDAN and SNYDER in 1900. The type is in the Stanford University Collection.

Head 3.75 in body-length; depth 2.5; eye. 2.75 in head; snout 4.25; length of caudal peduncle from last anal rays 1.4 in head, its depth 2; dorsal height 1.33; anal height 1.4. Dorsal ray II, 10; anal rays II, 9 or 10; scales in lateral series 32, in transverse, series between in seritons of vertical fins, 11, pharyngeal teeth 5–5.

Snout not overhanging premaxillaries, its tip level with center of eye; maxillaries extending to below anterior margin of eye; no barbel present; mouth but slightly oblique; tuberculated areas on snout of males not prominent in any specimens examined, nor are patches present before eyes; pharyngeal teeth hooked, with narrow grinding surface, without serrations or plicate sides; gill rakers short, 2+4.

Dorsal inserted nearer base of caudal than tip of snout by length of latter; first branched ray extending beyond the base of last, when spine; second ray spine-like with flexible tip, as long as succeeding, ray; first half length of second; last ray three-fifth length of third; outline of fin straight; anal similar in all respects, its insertion under fourth branched ray of dorsal; first branched ray barely reaching base of last one; pectorals 1.33 in head, just reaching base of ventral, latter four-fifths length of pectorals, and not reaching in sertion of anal.

Lateral line present in first four scales, series continuing, dropping sharply from fourth towards ventral line of body.

A blue-black lateral stripe, half as wide as pupil, beginning three or four scales from last scals on caudal base and continued to within eight scales of angle of gill opening, broadest part above anal base; shoulder-spot behind angle of gill-opening present in males only, represented in females by an occasional dusky area; in males very difinite, square, as large as pupil, followed by a similar silvery area and a subsequent dark blotch; line of back darkest just before dorsals; belly in males pigmented as usual; dorsal with a prominent, definite blue-black spot somewhat triangular, its tip at base of fifth branched ray, its base as wide as pupil and half-way up second spiny ray, this spot being apparently the anterior portion of a broad stripe which is posteriorly indistinct; distad a narrow dusky band parallel to margin of fin; other fins without visible pattern.

The males of this species are apparently slenderer than the females with a depth slightly more than two and one-half times in the body-length; the anal narrowly edged with black; a broader and more vivid lateral stripe and shoulder-spots. The belly is pigmented as usual. In one specimen the spot on the dorsal is lacking.

Distribution: Chikugo River, Kyûshû (JORDAN & THOMPSON).

Genus **Pseudoperilampus** BLEEKER, 1863.

Pseudoperilampus BLEEKER, 1863, Versl. Med. Ak. Vet. Amst. xv, p. 235.

Type: **Pseudoperilampus typus** BLEEKER.

Characters: Body short, deep and rhomboid. Head small, and the upper profile concave over the eye; eye large, in or above the axis of the body; interorbital space broad; snout bluntly pointed; mouth small, somewhat inferior; no barbels; pharyngeal teeth in a single row, 5 in number; upper jaw protractile. Lateral line incomplete, a dark streak in the middle of the side posteriorly. Intestine long. Peritoneum black. Scales small, and very narrowly imbricated, about 55 in lateral line. No scaleless keel

* JORDAN & THOMPSON, 1914, Mem. Carnegie Museum, vol. 6, no. 4, pp. 228–229.

before the anal fin. Gill membranes narrowly jointed to isthmus. Origin of dorsal fin nearer base of caudal than tip of snout, its base rather long, with 10 developed rays; anal with 10 developed rays, its origin before the vertical from dorsal axil; caudal emarginate; ventrals inserted before dorsal. This genus closely allied to *Rhodeus* but deeper, more, compressed, with smaller scales, more rays in dorsal and anal, teeth serrate.

45. **Pseudoperilampus types** BLEEKER.

Coin minnow, "Zenitanago"

(Text-fig. 70)

Pseudoperilampus typus BLEEKER, 1863, Versl. Ak. Vet. Amst., xv, p. 235. - GÜNTHER, 1868, Cat. Fish. Brit. Mus., vol. vii, p. 281. - BLEEKER, 1879, Enum. Esp. de Pois. Act. Conn du Japon, p. 24. - JORDAN et FOWLER, 1903, Proc. U. S. N. M., vol. xxvi, no. 1334, pp. 813-815, fig. 1. - JORDAN, SNYDER et TANAKA, 1913, Cat. Fish. Japan, p. 63, fig. 38. - TANAKA, 1921, Nihon Gyogaku, pp. 176-177, fig. 62. - JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, p. 161. - TANAKA, 1935, Fig. & Descrip. Fishes of Japan, pp. 55-57, pl. xiv, fig. 48. -UENO, 1935, Shinshû no Gyorui, pp. 213-214, figs. 110-111. - OKADA et IKEDA, 1938, Saito Hô-on Kai Mus. Resear. Bull., no. 15, pp. 99-100. - OKADA et NAKAMURA, 1948, Nihon no Tansui Gyorui, pp. 148-149, fig. 68.

Pseudoperilampus sp. ISHIKAWA, 1897, Prel. Cat., p. 12.



Text-fig. 70. ***Pseudoperilampus typus*** BLEEKER. ca. × 1.5

Description: Head $3^{3}/_{4}$; depth, $2^{1}/_{2}$; D. III, 10; A. III, 10; P. 12-14; V. 8; scales, 55 in the lateral line; 12 scales between origin of dorsal and lateral line, and 10 between the latter and middle of belly; pharyngeal teeth 5-5; width of head, $1^{2}/_{3}$ in its length; snout, $4^{2}/_{5}$ in head; eye, $3^{1}/_{2}$; interorbital space, $2^{1}/_{2}$; pectoral, $1^{2}/_{5}$; ventral, $1^{2}/_{3}$; depth of caudal peduncle $2^{1}/_{4}$.

Body oblong deep, rhomboid, and compressed; caudal peduncle also compressed. Head small, compressed and bluntly pointed; upper profile of head concave behind eyes;

snout less than eye, rounded above and bluntly pointed; eye rather large, lateral; mouth small, oblique, terminal, lower jaw slightly projecting; the maxillary protractile and reaching below the nostrils, but not to the anterior edge of eye, without barbel; lips rather thin; paryngeal teeth brown, compressed, one-rowed 5–5, with a narrow grinding surface, the sides serrate, and the tips slightly hooked; nostrils close together on the snout in front of eye; interorbital space and top of head broad and slightly convex. Gill openings rather large, lateral, free from the isthmus; gill-rakers rudimentary, about 3 + 13; pseudobranchial present, well-developed. Intestine long, with many covolutions. Peritoneum black. Scales rather small, and all more or less very narrowly imbricated, so that they are much deeper than long; no pectoral flap; ventral flap present.

Origin of dorsal nearer base of caudal than tip of snout, the anterior rays the highest, the base of the fin about equal to the head, and the third rudimentary ray stronger than the others; anal inserted below fourth developed ray of dorsal, somewhat smaller, with 11 developed rays; caudal emarginate, the lobes pointed; pectoral reaches to within a short distance of ventral; origin of ventral well before that of the dorsal, or nearer tip of snout than base of caudal, and reaching within a short distance of origin of anal. Caudal peduncle compressed, and its least depth a little over 2 in head. Lateral line slightly decurved and continuous. Scales cycloid, very narrowly imbricate. Lateral line

Table 47. Measurement of *Pseudoperilampus typus* BLEEKER.

Reg. No. of Saitô Ho-on Kai Museum	Standard length	Depth of body	Head	Snout	Eye	Interorbital space	Maxillary	Depth of caudal peduncle	Numbers of fin ray		Numbers of scales		
									D.	A.	dorsal	In longitudinal series	In transverse series
	mm	in L.	in L.	in H.	in H.	in H.	in H.	in H.					
15365	50.9	2.3	3.5	3.5	3.6	2.5	4.5	2.3	11, 11+1	11, 10+1	28	51	18
,,	57.2	2.5	3.7	3.3	3.6	2.5	4.1	2.3	11, 11	11, 11	29	53	19
15894	53.2	2.4	3.7	3.4	3.3	2.5	4.9	2.5	11, 11+1	11, 11	27	56	19
,,	54.1	2.4	3.5	3.4	3.5	2.5	4.6	2.8	11, 11	11, 10	25	56	19
,,	56.9	2.4	3.6	3.7	3.5	2.7	5.1	2.5	11, 11	11, 11	27	54	19
,,	56.9	2.4	3.6	3.5	3.0	2.5	4.5	2.5	11, 12	11, 11	28	58	21
,,	61.7	2.5	3.7	3.3	3.4	2.6	4.6	2.7	11, 11	11, 11	26	57	19
	62.6	2.4	3.5	3.5	3.5	2.7	4.3	2.8	11, 11	11, 11+1	28	58	20
15995	45.0	2.5	3.4	3.5	3.2	2.7	4.6	2.7	11, 11	11, 11+1	27	57	18
16205	40.0	2.9	3.4	3.2	3.3	2.7	4.0	2.7	11, 10	11, 11	24	58	18
,,	41.5	2.8	3.2	3.3	3.2	?	5.1	2.8	11, 11	11, 11	25	50	18
,,	41.9	2.7	3.4	3.3	3.3	2.6	4.1	2.7	11, 10	11, 11	25	52	18
,,	42.4	2.7	3.5	3.4	3.6	2.7	4.5	2.7	11, 11	11, 11	29	57	17
,,	45.5	2.8	3.4	3.3	3.7	2.6	4.4	2.9	11, 10	11, 11	28	56	17
,,	46.6	2.6	3.3	3.3	3.8	2.7	4.2	2.8	11, 11+1	11, 10	28	52	18
20161	32.4	2.6	3.5	3.2	3.2	2.7	3.9	2.6	11, 11	11, 11	26	52	18
,,	34.8	2.7	3.4	3.5	3.2	2.8	5.1	2.8	11, 11	11, 11+1	—	—	—
,,	34.9	2.5	3.5	3.1	3.3	2.7	4.5	2.5	11, 11	11, 11	25	50	17
,,	36.7	2.4	3.2	3.7	3.7	2.8	5.0	2.7	11, 11	11, 11	26	51	19
,,	37.6	2.7	3.5	3.1	3.8	2.9	4.7	2.7	11, 11+1	11, 11	—	—	—
,,	38.3	2.6	3.4	3.2	3.5	2.6	4.3	2.6	11, 11	11, 11	26	51	18
,,	40.7	2.7	3.3	3.4	3.8	3.0	4.8	2.8	11, 10	11, 11	27	54	18
,,	42.7	2.7	3.4	4.0	3.7	3.1	4.6	2.8	11, 11	11, 11	29	49	18
,,	67.3	2.5	3.8	3.8	3.8	2.7	4.4	2.4	11, 11	11, 11	31	51	18

complete, decurved. Color in alcohol, dark brown above, pale or silvery below, and each scale above and on the sides with a narrow brown margin, forming a reticulated appearance; top of head and snout dark brown; dorsal dusky, with about 4 longitudinal rows of brown spots; anal light dusky, with 2 longitudinal rows of faint spots; all other fins also light dusky, without markings; caudal and pectoral grayish; ventral pale; sides with a pale lateral streak, becoming more distinct and darker along the sides of caudal peduncle; a dark blotch above and behind gill-opening.

Habits: This fish mature in one year after hatching. Around Tokyô, the breedng season occurs from the end of September to the beginning of November. In the breeding season, the male has pearl organs and nuptial colour while the female has developed greyish ovipositor. They are distributed in northern part of Honshû, found mostly in shallow swamp and pond with dense vegetation. Recently, they are transplanted into Lake Suwa. In autumn, they spawned in branchial cavities of *Anodonta japonica* and *Cristaria plicata* by intruding their ovipositor. Eggs are yellowish and elliptical pointed at both ends, measured 1.1–1.4 mm. × 3.1 – 3.3 mm. in size. The just hatching out embryo is about 4 mm. in body length, slender, with a large yolk sac. Larvae stay in the branchial chamber for a while and winter there in an active condition. About April to May of the next year, the elarvae swam out the mussel into the waters, after absorption of yolk sac. The fish live in stagnant current rivers or in ponds and swamps where the water plants are abundant on the muddy bottom. They are omnivorous and feed chiefly on micro-organisms and organic matters.

Type locality: Tôkyô.

Distribution: The present species is distributed in the northern Honshû except Aomori Prefecture. River Kitakami, Iwate Prefecture (Aoyagi); River; Tenryû River Toyo, Aichi Prefecture (Okano); Lake Suwa (transplanted spontaeneously into Lake Suwa from Kasumigaura together with *Anodonta japonica*); Northern Akita Prefecture; River Omono; Hachirogata (Ide & Aoyagi); Hyôgo Prefecture (Ogami); Lake Biwa (Jordan & Hubbs); Takakanuma, Aomori Prefecture (Tamura). Turuga, Etizen; Tutiura, Ibaraki Prefecture; Matsusima, Miyagi Prefecture; Tôkyô Fish Market (Jordan, Fowler); Lake Kasumigaura (Hattori); Lake Biwa (Jordan); Tôkyô; Teganuma (Ishikawa); Tôkyô; Tatebayashi, Gunma Prefecture; Teganuma, Chiba Prefecture (Okada, Nakamura); Yamagata Prefecture; Iwate Prefecture; Miyagi Prefecture. (Okada, Ikeda); Tsuchiura, Ibaraki Prefecture (Tanaka).

Genus **Pungtungia** Herzenstein, 1892.

Pungtungia Herzenstein, 1892, Bull. Ac. Imp. Sci. St. Pet., xiii, p. 231.
Zezera Jordan et Fowler, 1903, Proc. U. S. N. M., xxiv, p. 837.

Characters: Body elongate, oblong, and compressed. Head rather small, depressed, and pointed, the upper and lower profiles straight; snout long; eye rather small; mouth

small, terminal, oblique; upper lips rather broad; barbels 2, rather long, but shorter than eye; teeth small, 5–5; interorbital space broad and flattened. Intestine short. Peritoneum silvery. Scales small, cycloid, and not imbricated; 42 in the lateral line. Origin of dorsal midway between tip of snout and base of caudal; anal inserted behind tip of depressed dorsal; caudal emarginate; ventral inserted slightly before origin of dorsal. Caudal peduncle rather deep and compressed. Lateral line straight and continuous.

46. **Pungtungia hilgendorfi** (Ishikawa).

"Mugitsuku"

(PL. XXV, figs. 1–9)

Sarcocheilichthys hilgendorfi Ishikawa, 1902, Ms.

Zezera hilgendorfi Jordan et Fowler, 1903, Proc. Nat. Mus., vol. xxvi, no. 1334, pp. 837–838. – Ishikawa, 1904, Proc. Dep. Nat. Hist. Tôkyô Imp. Mus., I, p. 3, pl. II. – Tanaka, 1921, Nihon Gyogaku, p. 188. – Tanaka, 1913, Fishes Japan, pp. 81–83, pl. xix, fig. 71; pl. xxi, figs. 78–79.

Pungtungia hilgendorfi Jordan et Hubbs, 1925, Mem. Carn. Mus., p. 176. – Miyadi, 1935, Kyôtofu Tansuigyo, pp. 29-30, pl. 4, fig. 23. – Niwa, 1954, Fish Kiso Valley, pp. 171, 240, 277.

Pungtungia herzi Herzenstein, 1892, Bull. Ac. Imp. Sci. St. Pet., xiii, p. 231. – Okada et Nakamura, 1948, Nihon Tansuigyo, p. 166, fig. 89. – Aoyagi, 1959, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 110–111, fig. 88.

The original description* is as follows;

Zezera hilgendorfi (Ishikawa)

Sarcocheilichthys hilgendorfi Ishikawa, new species of Japanese fishes Ms. 1902.

Head $4\frac{1}{2}$; depth $3\frac{3}{4}$; D. III, 7; A. III, 6; P. 16; V. 8; scales 42 in the lateral line; 6 scales between origin of dorsal and lateral line, and 6 between latter and middle of belly; pharyngeal teeth 5-5; width of head $1\frac{1}{2}$ in its length; snout 3 in head; eye $4\frac{1}{4}$; interorbital space $2\frac{1}{4}$; pectoral $1\frac{2}{5}$; ventral $1\frac{1}{3}$.

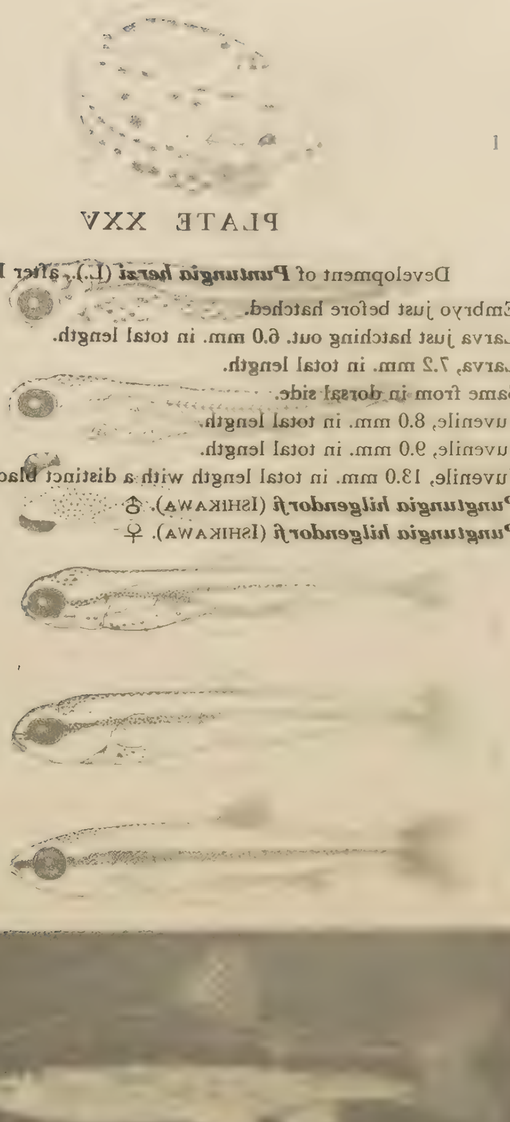
Body elongate, oblong, and compressed. Head rather small, depressed, elongated, pointed, and the upper and lower profiles straight; snout long, pointed; eye rather small, anterior, and about $1\frac{3}{5}$ in snout; mouth small, terminal, very oblique, the mandible slightly produced in front, the maxillary protractile and not reaching the nostril; upper lips rather fleshy and dilated, the edge of the mandible more or less horny in the middle; maxillaries each with a barbel that is less than the eye; teeth small, weak, and hooked; nostrils close together on the sides of the snout and nearer the posterior extremity of the maxillary than the anterior margin of the eye; interorbital space broad and flattened, or only very slightly convex. Gill-opening rather restricted; gill-rakers small, few and weak; pseudobranchiae present. Intestine short. Peritoneum silvery.

Scales moderate, cycloid, and not imbricated; no pectoral flap; ventral flap present.

Origin of the dorsal midway between tip of snout and base of caudal, the anterior rays the longest, and when depressed, the tip of the fin does not reach the origin of the anal; anal inserted a little nearer base of caudal than tip of pectoral; the fin short and reaching half way to base of caudal; caudal rather deep, emarginate; pectorals reaching about two-thirds the distance to origin of anal; ventral inserted slightly before the origin of the dorsal, or a little nearer the origin of the anal than that of the pectoral, and reaching two-thirds the distance to fomrer.

Caudal peduncle deep and compressed, its least depth about $1\frac{2}{3}$ in the head. Lateral line straight

* Ishikawa, 1902, Ms.



1



PLATE XXV

Development of ***Puntungia herzi*** **(L.), after K. Uchida.**

1. Embryo just before hatched.
2. Larva just hatching out. 6.0 mm. in total length.
3. Larva, 7.2 mm. in total length.
4. Same from in dorsal side.
5. Juvenile, 8.0 mm. in total length.
6. Juvenile, 9.0 mm. in total length.
7. Juvenile, 13.0 mm. in total length with a distinct black stripe.
8. ***Pungtungia hilgendorfi*** **(Ishikawa). ♂**
9. ***Pungtungia hilgendorfi*** **(Ishikawa). ♀**

PLATE XXV



1



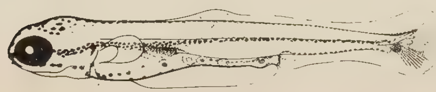
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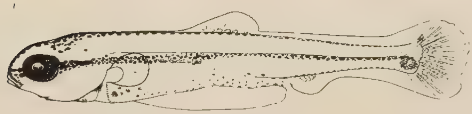
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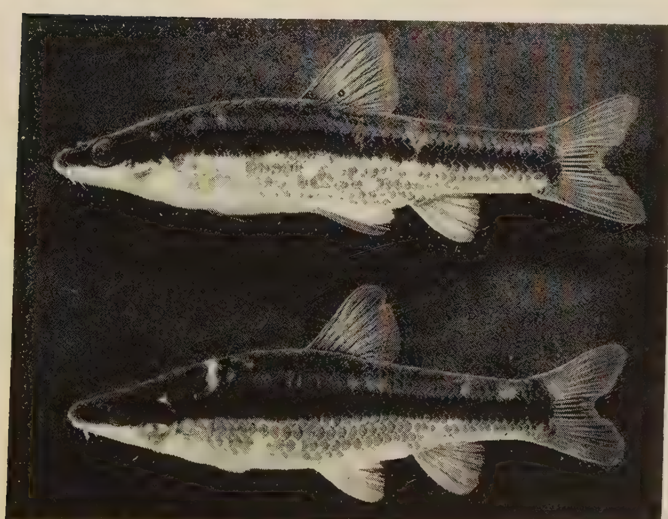
5



6



7



8

9

and continuous.

Color, in alcohol, dark brown, tinted with dull oilvaceous above, below pale or whitish; the lateral line is within a broad, deep brown, lateral band, which really begins on the snout, passing through the eye and backwards, even upon the middle caudal rays; lips pale; some of the scales on the lower portions of the sides tinted with pale brown; dorsal, caudal, and pectorals grayish, the other fins pale like the belly.

Length 4 1/8 inches.

We have but two examples of this species, the specimen described (No. 7722 L. S. Jr. Univ.) above from Funayado, in Kiusiu, the other in the U. S. National Museum, from the Kamo River, in Yamashiro, from the collection of the Imperial University. Dr. ISHIKAWA's specimens the types of the species, came from the Ahasi River, in Mimisaku. (Named for Dr. FRANZ HILGENDORF).

Description: Head 4, depth of body 4 1/4 in total length without caudal. Eye 5; interorbital 2 1/4, snont 2 1/2 in head. D. III, 7; A. III, 6; P. 16; V. 8; C. 18; scales 42 in lateral line; pharyngeal teeth 5–5.

Body rather elongate, compressed; dorsal and ventral contours evenly curved, but the nape slightly elevated; caudal peduncle deep but narrow, compressed. Head rather small, depressed, elongated, pointed; straight in profile but rather steep; eye rather large, high, lateral; interorbital broad, slightly convex; nostrils close together on the sides of the snout; anterior one with a broad, thin flap on the posterior margin; snout rather large, its profile with a strong depression at the middle, resulting from a narrow groove across back in front of eye. Mouth small, subterminal, slightly oblique; maxillary not extending to vertical through anterior nostril; its barbel slightly is less than diameter of eye; upper lip rather thick. Gill-openings lateral, joined to the broad isthmus; gill-rakers on first gill-arch weak, stumpy 3+7; pharyngeal teeth 6–5, the edges entire, tip hooked; pseudobranchiaewell developed. Scales moderate, cycloid, and not imbricated. Lateral line continuous, on the middle body. Dorsal inserted midway between tip of snout and base of caudal; the rays granuated, first branched one being longest; anal inserted entirely behind dorsal and nearer to origin of ventral than to base of caudal; pectoral reaching about two-thirds the distance to origin of anal; without flap;

Table 48. Measurements of *Pungtungia herzi* HERZENSTEIN.

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total tength	108.0mm.	Head/Interorbital width	2.77mm.
Body length	89.0	Head/Diameter of Eye	5.00
Body length Head	3.56	Head/Length of Caudal peduncle	1.25
Body length Depth	4,45	Head/Depth of Caudal peduncle	2.08
Body length/Predorsal length	1.98	Head/Length of Dorsal fin	2.08
Body length/Prepectoral length	3.87	Head/Length of Anal fin	3.84
Body length/Preventral length	1.94	Head/Height of Dorsal fin	1.31
Body length/Preanal length	1.35	Head/Height of Anal fin	2.08
Head/Snout	2.50	Head/Pectoral length	1.56
Head/Upper jaw	4.17	Head/Ventral length	1.78
Date	VI, 1934		
Locality	River Yodo		

* Ôtsu Hydrobiological Station, attached to Kyôto University.

ventral inserted below first branched ray of dorsal, with a distinct flap; caudal strongly emarginate. Caudal peduncle deep and compressed, its least depth about $1^2/_3$ in the head.

Color in formalin grayish brown, pale beneath; a broad dark brown band runs from tip of snout through eye along lateral line to base of caudal; each scale appearing dusky from close punctulations but its posterior margin pale; dorsal light dusky with about three oblique rows of very faint spots; caudal dusky, without distinct markings; other fins all plain and pale.

Type locality:- Funayado, Kyûshû.

Distribution: Kumamoto, Hamada (Wakiya); Himeji (Abe); Yamaguchi (Ishikawa); Funayado, Kyushû (Ishikawa); River Kamo, Yamashiro (Jordan & Fowler); River Kino; River Arita, Wakayama Prefecture (Ui); River Yoshino, Nara Prefecture (Tsuda); River Kiso (Niwa); Kyotofu (Miyadi); Lake Biwa (Tanaka); Lake Biwa; River Yodo (Tanaka, Miyadi); River Kino (Tanaka); Kashihabara, Hyogo Prefecture (Nakagawa); River Asahi; River Tsuyama, Okayama Prefecture (Ishikawa); Himeji, Hyôgo Prefecture; Hamada, Shimane Prefecture; Yamaguchi, Yamaguchi Prefecture; Kumamoto; Funashiku, Kumamoto Prefecture; (Jordan, Hubbs); River Chikugo; River Yabe, Kumamoto Prefecture; Nagasaki, Nagasaki Prefecture; River Ôyodo; Miyakonojo Miyazaki Prefecture, (Aoyagi).

Remarks: Jordan and Hubbs examined the specimens of *Pungtungia herzi* collected in the River Han, Korea and described the differences between the present species and *Pungtungia herzi*. The latter species usually has the teeth 5–5, and somewhat longer snout being a lttle longer than the postorbital. Furthermore they remarked that the Japanese genus *Zezera* from Lake Biwa seems inseparable from *Pungtungia*.

The present species are distributed far west of Lake Biwa. They are dwelling in the river with many pebbles and stones, generally they are lying concealed under the stones and in the crevices of rocks.

They are feeding on small animals and other organic matters attached to stones. The breeding habits is unknown in Japan. According to Uchida, K. (1939), in the south of Korea, it gathers on the stony basin of clear waters in May and deposits eggs under the stones or in the cleft. Eggs are nearly cubical, light brown, measuring 1.8 mm. in diameter. The just hatching out larva is about 6 mm. in body length and has 35 myomeres Tsuda, M.,* reported that the present species collected from River Yoshino mainly feeds on diatomes.

47. Pungtungia shiraii Oshima.

"Shirai-mugitsuku"

Pungtungia shirai Oshima, 1957, J, J. I, vol 6, nos. 1–2, pp. 15–16, fig. 1.

* Tsuda, M., 1953, Naraken Sôgô Bunka Chôsa Hôkoku. Yoshinogawa Ryuiki.

The original description is as follows:

Pungtungia shiraii sp. nov.* Shirai-mugitsuku (new name)

Head 3,20 in length; depth 4,70; depth of caudal peduncle 3,16 in head; eye 4,75; snout 2,72; interorbital space 3,80; pectoral 1,90; ventral 2,10; D. II, 7; A. 2,5; P. 18; V. 9; pharyngeal teeth; 4-4; scales 6-46-9.

Body elongate, oblong and compressed; head large, elongate, conical, upper and lower profiles nearly straight; snout long, pointed anteriorly; eye moderate, superior and in the middle of head; mouth rather small, oblique and subinferior, its angle not reaching a vertical through front edge of anterior nostril; lips thin and fleshy; one pair of short maxillary barbel near the angle of mouth; edge of the mandible rounded, not horny; pharhyngeal teeth slender, high and pointed; nostrils close together, in front of eye, much nearer to orbit than tip of snout, interorbital space broad and flat, boundary between the post-nasal space distinctly depressed; gill-openings moderate; gill-rakers rudimentary, short and few in number; pseudobranchiae present.

Scales cycloid, thin and minute, not imbricated; pectoral and ventral flaps present.

Origin of dorsal much nearer to tip of snout than the base of caudal, 2nd ray the longest, somewhat spiny, when depressed the tip of the fin does not reach the origin of anal, base of the fin 2, 10 in head, outer margin slightly concave; anal inserted midway between origin of ventral and base of caudal, the fin rather short, outer margin nearly straight; caudal elongate and deeply emarginate, tips of both lobes sharply pointed; pectorals short, reaching about two-thirds the distance to origin of ventrals; ventrals inserted a little before posterior end of the dorsal; anus one scale before the origin of anal; lateral line neary straight, running along the middle of sides, anterior portion slightly decurved.

Color in formalin pale gray above, paler and whitish below, top of head and snout uniformly gray; back indistinctly maculated with black; a longitudinal series of irregula black spots along the lateral line above; dorsal and anal uniformly gray, outer margin of the former blackish; the rest of the fin whitish.

Total length 74 mm.

Described from a specimen collected in Tama River near Denyenchôfu in May, 1952.

Remarks. - The present species differs from *Pungtungia hilgendorfi* chiefly in having different formulae of pharyngeal teeth and number of scales. Colouration also differs markedly having no broad lateral band of deep brown along the lateral line.

Genus Sarcocheilichthys Bleeker, 1860.

Sarcocheilichthys Bleeker, 1860, Cyprin. Prodr. p. 426.

Characters: Body elongate, oblong, and compressed. Head elongate, bluntly pointed, and compressed; snout blunt and obtusely rounded; eye small; mouth small, inferior; lips rather thick and fleshy; a very small and short maxillary brabel; teeth, 5–5; interorbital space convex. Intestine short. Peritoneum silvery. Scales rather small, 42. Origin of dorsal snout than base of caudal; anal inserted below tip of depressed dorsal; caudal emarginate; ventrals inserted a little behind origin of dorsal. Lateral line almost straight and continuous. Breeding males with horny tubercles on snout and sides of head.

* Ôshima, 1957, J. J. I., vol. 6, nos. 1-2, pp. 15-16, fig. 1.

48. Sarcocheilichthys variegatus (Temminck et Schlegel). Red Dace, Cherry minnow, "Higai, Sakurabae" (PL. XXVI, figs. 1–4; PL. XXVII, figs. 1–3)

Leuciscus variegatus Schlegel, 1846, Fauna Japonica Poiss., p. 213, pl. CII, fig. 2. - Jordan et Snyder, 1901, Prel. Check List Fish. Jap., p. 46.

Pseudogobio variegatus Günther, 1868, Cat. Fish., VII, p. 175. - Ishikawa, 1895, Zool. Mag. Tokyo, vii, pp. 125-127. - Ishikawa, 1897, Prel. Cat., p. 15. - Sauvage, 1883, Bull. Soc. Philom., p. 3.

Sarcocheilichthys variegatus Jordan et Snyder, 1901, Prel. Check List Fishes Japan, p. 46. - Jordan et Fowler, 1903, Proc. U. S. N. M., vol. xxvi, pp. 833-834. - Tanaka, 1911, Fishes of Japan, pp. 6–7, pl. II, fig. 7. - Jordan, Tanaka et Snyder, 1913, Cat. Fish. Japan, p. 68. - Tanaka, 1921, Nihon Gyogaku, pp. 187-88. fig. 64. - Jordan et Hubbs. 1925, Mem. Carn. Mus., p. 175. - Miyadi. 1935, Shinsyû no Gyorui, p. 216, fig. 114. - Miyadi, 1935, Kyôto fuka no Tansuigyo, pp. 28-29, pl. 4, fig. 22. - Okada, et Matsubara. Uchida, 1935, Nihon Gyorui Zusetsu, p. 85, pl. 30, figs. 1-2. - Okada et Nakamura, 1948. Nihon no Tansuigyorui, pp. 164-165, fig. 87. - Aoyagi, 1957, Gen. Note Fresh. Wat. Fish., pp. 113–116. figs. 90.

Sarcocheilichthys microoculus Mori, 1927, Ann. Zool. Jap., vol. 11, no. 2, pp. 98-100.

The original description* is as follows:

Leuciscus variegatus

Pl. CII, fig. 2.

Tout en rappelant par les formes de son corps et de sa tête ainsi que par l'ensemble de sa physionomie, le Véron ou *Leuciscus phoxinus* des eaux d'Europe, cette espéce nouvelle en différe cependant, outre sa taille plus forte, sous un grand nombre de rapports, notamment par ses écailles beaucoup plus grandes, par son profil plus bimbé, par sa bouche moins spacieuse, par ses grosses lévres, par sa dorsale plus avancée, et par d'autres caractéres moins saillnats. Des cinq individus de notre collection, et plus petit porte deux pouces et le plus grand six pouces en longueur totale.

La grosseur du corps est deux fois et un quart dans sa hauteur, qui entre en viron quatre fois et demie dans la longueur comprise entre le bout du museau et l'échancrure de la caudale. La tête est á peo prés cinq fois dans cette longueur. Le museau fait le tiers, et le diamétre de l'aeil le quart de la tête; l'intervalle des yeux, enfin, égale la longueur du museau. La ligne arquée qui sépare la tête de la nuque, forme qu milieu une légére saillie arrondie; le dessus de la tête est fortement arrondi vers les côtés; la ligne du profil descend subitement vers le bas en avant des narines, oú le dessus du museau est un péu rétréci; cette ligne fait ensuite, pour atteindre l'intermaxillaire, une deuxiéme courbe en pente assez raide. Les narines, cormme d'ordinaire doubles, sont placées assez haut, sur la fin du troisiéme quart da le longueur du museau. Le museau étant arrondi; á son extrémité, l'intermaxillaire est un peu rentrant; la mâchoire inférieure est plus courte que la supérieure. La bouche est très-étroite, et le maxillaire, quoique assez épais, ne s'étend en arrière que jusque sous l'aplomb des narines. La ligne de la bouche fait avec l'axe longitudinal du corps un angle de quinze degrés. Les lèvres sont assez charnues, et elles forment de chaque côté de la mâchoire inférieure, un volie pendant, court il est vrai, mais assez épais. Le premier sous-orbitaire est passablement large et s'étend sous les narines jusque vers le bord du maxillaire supérieur; les autres sous-orbitaires entourent l'aeil en bas et par derrière en guise d'une bande dont la largeur n'égale que le tiers du diamètre de cet organe. Les bords du préopercule forment un angle un peu obtus et arrondi; l'opercule est arrondi, mais on voit au milieu de son bord libre une petite saillie également arrondie. La peau de la tête est nue etá surface unie; mais elle devient rugeuse sur la moitié antérieure du museau, où l'on voit de petites fossettes irrégulièrement distribuees. L'os principal du bras forme, comme à l'ordinaire, une forte saillie anguleuse

* Temminck et Schlegel, 1846, Fauna Jap. Poisson, p. 213.

au dessus de la base des pectorales. La ligne latérale se prolonge en direction droite sur le milieu du corps, mais elle monte un peu vers le haut vis-à-vis de la moitié de la longueur des pectorales, afin de se diriger sur l'angle supérieur de la fente des ouies. Les écailles sont passablement grandes et au milieu de leur bord postérieur un peu évasées en angle arrondi; leur surface est couverte de stries extrêmement serreés, plus saillantes vers le bord des écailles, qu'elles dépassent quelquefois en guise de petits cils. On compte environ 43 écailles sur la ligne latérale, et entre le ventre et le dos 11 rangées d'écailles, dont cinq au dessus de la ligne latérale. L'anus est un peu plus rapproché de l'anale que des ventrales, et s'ouvre sur la fin du troisiéme cinquieme de la longueur comprise entre le bout du museau et l'échancrure de la caudale.

Les pectorales naissent sur la ligne de l'angle de la bouche, leur longurur égale deux tiers de la hauteur du corps; elles sont arrondies et avec leur pointe distantes de l'anale à un intervalle surpassant le tiers de leur longueur. Les ventrales, également arrondies, ne sont que d'un sixième plus courtes que les pectorales; elles se prolongent un peu au delà de l'orifice de l'anus, et leur extrémité est éloignee du commencement de l'anale á une distance égalant le tiers de leur longueur. Le bord inférieur de l'anale est tannt soit peu concave; cette nageoire est par derrière presque de moitié plus basse que par devant, oü sa hauteur égale la longueur des ventrales; elle est précédée par trois rayons indivisés, assez forts quoique flexibles, et dont le dernier est presque aussi long que le rayon mou qui le suit, tandie qui le second est de plus de moitié plus court, et que le premier sort à peine de la peau; les rayons mous de cette nageoire sont assez larges vers le bout et divisés en plusieurs branches toutes séparées par des membranes. La caudale est fourchue, ses lobes libres sont assez larges et peu pointus. La dorsale nait sur la ligne qui repond a la fin du troisieme quart de la distance comprise entre l'aiselle des pectorales et le commencement des ventrales; elle est presque de moitie plus basse par derriere que par devant, ou sa hauteur surpasse un peu la longueur des pectorales; ses deux rayons indivises sont robustes et durs a leur moitie infèrieure, et flexibles a la superieure; le premier est de plus de moitie plus sourt que le second, qui egale en longueur le rayon mou suivant. D. 2+7; A. 3+6; V. 1+7; P. 16; C. 19.

Ce poisson conserve dans l'esprit de vin offre, comme tous ceux du genre dont nous traitons, une teinte argentee, mais cette teinte est a l'exception des parties inferieures, en grande partie couverte par un grand nombre de taches verticales brunes mal determinees et confluentes sur le dos; ces taches snont en outer parsemees d'innombrables petits points noirs. On voit une tache noire et verticale derriere l'os principal du bras. Les nageoires sont jaunatres; mais la dorsale est ornee vers le haut d'une bande foncee tres-large; il existe des traces presque imperceptibles de bandes analogues sur l'anale, les ventrales et les pectorales. La caudale tire au brun. Les jeunes individus offrent en general des teintes plus claires, le corps n'est ordinairement varie de brun que sur le dos; mais la bande foncee de la dorsale est quelquefois tres-apparente.

Description: Head $3^2/_5$, depth of body 4 in total length without caudal. Eye $5^1/_2$; interorbital $3^1/_4$, snout $2^3/_4$ in head, interorbital space $3^1/_4$; pectoral $1^1/_3$; ventral $1^1/_2$, D. III, 9; A. II, 7; P. 15; V. 8; scales 42 in lateral line.

Body rather elongate, oblong, compressed. Head elongate, bluntly pointed and compressed; snout moderately long, compressed, very blunt; eye small, rather hight, interorbital space broad, convex; mouth small, inferior, protractile, the maxillary extending scarcely to vertical from anterior nostril; lips thick, rather broad, fleshy; a very small, short maxillary barbel. Gill-membranes broadly joined to the isthmus. Pseudobranchiae well developed. Pharyngeal teeth hardly hooked and with broad grinding surface; 5–4; gill-rakers on first gill-arch very short, blunt, 3 + 4. Peritoneum silvery. Intestine with a single convolution. Dorsal inserted midway between tip of snout and base of caudal. Anal inserted below dorsal. No pectoral flap. Ventral inserted behind origin of dorsal,

with a scaly flap. Caudal deeply emarginate, the lobes pointed. Scales large, cycloid. Lateral line very slightly decurved, continuous. Scales large, cycloid, and imbricated along the sides.

Color in formalin brown above, pale beneath. Scales of upper part of sides mostly edged with dark brown. A rather broad dark brown longitudinal band along the lateral line, becoming very distinct posteriorly; another similar longitudinal band on the back; a black crescent mark behind edge of opercle. Dorsal dusky, with a trace of a dark cross bar. Caudal also dusky. Pectoral rather dusky. Ventral as well as anal pale, without markings. Male deep steel blue in life, a dark lateral shade interrupted on tail to form a caudal spot.

Table 49. Measurements of *Sarcocheilicthys variegatus* (TEMMINCK et SCHLEGEL).

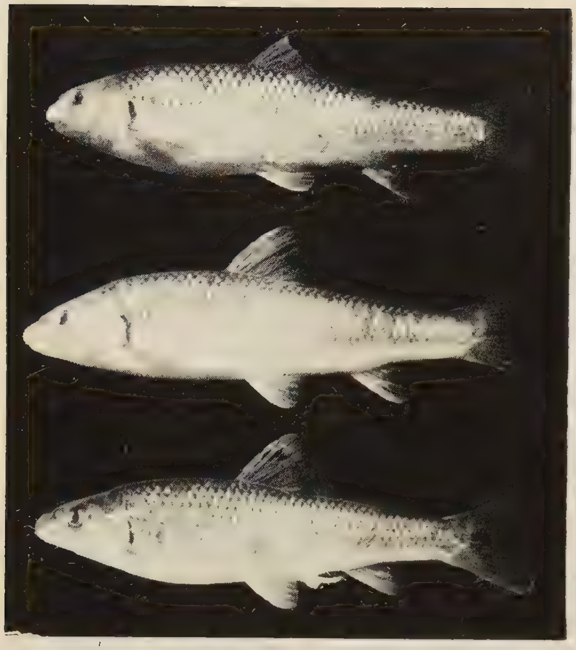
Collection	O. H. B. S.*				
Tatal length	300.0mm.	180.0mm.	104.0mm.	107.0mm.	120.0mm.
Body length	268.0	152.0	86.0	91.0	98.0
Body lengtq/Head	6.20	4.32	4.84	4.14	4.30
Body length/Depth	6.93	4.12	4.42	4.33	3.88
Body longth/Predorsal length	3.25	2.18	2.24	2.12	2.23
Body length/Prepectoral length	6.25	4.00	4.53	4.13	4.25
Body length/Preventral length	3.32	1.97	2.05	1.94	1.95
Body length/Preanal length	2.41	1.41	1.41	1.38	1.39
Head/Snout	2.80	2.55	2.97	3.67	3.35
Head/Upper jaw	4.20	3.90	3.56	4.23	3.62
Head/Interorbital width	3.16	3.20	2.74	3.28	3.17
Head/Diameter of Eye	5.50	5.42	3.56	4.58	4.57
Head/Length of Caudal peduncle	1.29	1.17	1.20	1.32	1.12
Head/Depth of Caudal peduncle	2.47	2.34	1.78	2.32	1.90
Head/Length of Dorsal fin	2.00	1.96	1.55	1.92	1.76
Head/Length of Anal fin	3.11	3.20	2.28	3.34	3.52
Head/Height of Dorsal fin	1.40	1.33	1.07	1.27	1.08
Head/Height of Anal fin	1.72	1.68	1.16	1.65	1.37
Head/Pectoral length	1.43	1.38	1.08	1.33	1.20
Head/Ventral lenght	1.83	1.62	1.27	1.63	1.36
Date	V, 1954			III, 1916	
Locality	Lake Biwa, Shiga Pref.			Tsuyama, Okayama Pref.	

* Ôtsu Hydrobiological Station, at Otsu, attached to Kyôto University.

Type locality: Nagasaki.

Distribution: Nagasaki (SCHLEGEL); Matsubara, Lake Biwa, River Yodo, Osaka; River Chikugo, Kurume, Kyûshû; Lake Yogo, near Nagoya; Hunayado, Kyûshû; Tsutiura, Ebaraki (JORDAN & FOWLER); Lake Biwa (JORDAN, KAWAMURA); River Kati at Nagoya (JORDAN), Kumamoto (WAKIYA); Himezi (ABE); Lake Suwa (OTA); Lake Mikata, Kasumigaura (HATTORI); Lake River (MORI); Southern Japan; Tsuchiura, Prov. Hitachi; Tôkyô; Gifu, Prov. Mino; Lake Yogo; Lake Biwa; River Yodo at Osaka; Tsuyama, Prov. Miyasaka; Okayama, Prov. Bizen; River Chikugo at Kurume; Funayodo, Kyûshû (TANAKA); Lake Suwa introduced Nagano Prefecture; Kasumigaura (introduced), Ibaraki Prefecture (MIYADI); Ôtsu; Matsubara; Maebara; Lake Biwa;

PLATE XXVI



1

2

3



4

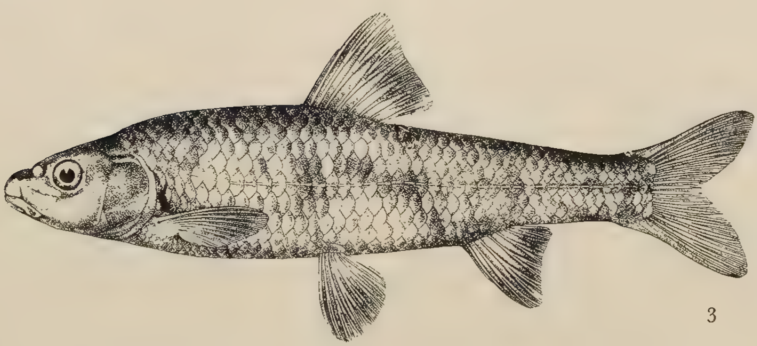
1. ***Sarcocheilichthys variegatus*** (TEMMINCK et SCHLEGEL), Lake Biwa. ♂
2. ***Sarcocheilichthys variegatus*** (TEMMINCK et SCHLEGEL), Lake Biwa. ♀
3. ***Sarcocheilichthys variegatus*** (TEMMINCK et SCHLEGEL), Lake Biwa. ♀
4. ***Sarcocheilichthys variegatus*** (TEMMINCK et SCHLEGEL), Lake Biwa. ♀
   after M. NAKAMURA.



1



2



3

1. ***Sarcocheilichthys variegatus*** TEMMINCK et SCHLEGEL. ♂
2. ***Sarcocheilichthys variegatus*** TEMMINCK et SCHLEGEL. ♀
3. ***Sarcocheilichthys variegatus*** TEMMILCK et SCHLEGEL. ♂

Zeze; Tsuyama; River Minasuka; Kii (ISHIKAWA); Lake Biwa (SAUVAGE); Ôtsu; Matsubara; Maebara; Lake Biwa (JORDAN & SNYDER); Hachirôgata, Akita Prefecture; Shinjiko, Shimane Prefecture; Toyama; Aichi Prefecture; River Tenryû, Shizuoka Prefecture (OKADA).

Remarks: The present species is distributed far west of Toyohashi, Honshû, Kyûshû and Shikoku. Recently they are transplanting into Kasumigaura, Ibaraki Prefecture and Lake Suwa, Nagano Prefecture and other lakes. They are dwelling on sandy bottom of clear water and feeding on small bottom animals. Spawning season is spring. The female is provided with short ovipositor, deposited eggs into the mantle cavity of small *Anodonta* or other freshwater bivalves measured under 100 mm. in size.

JORDAN and FOWLER[1)] remarked the difference of color and marking in adults and youngs as follows. "The young of this species differs in color from the adult, as the markings are much more distinct. The dorsal fin is pale, like the ventrals or anal, and is crossed by a jet black bar. The lateral band is also very distinct and generally results in a black blotch at the base of the caudal". They also added the secondary sexual characters of male covered with horny tubercles (pearl organs) on the snout during the breeding season.

ISHIKAWA[2)] mentioned the fresh coloration of this fish in young and adult as follows. "Small individuals of about seventy mm. are of an yellowish ochre on the dorsal half of the body with bluish tint on the dorsum. Beautiful scales of a sky-blue-colour in front of the dorsal fin. Irregular markings of sepia-brown-colour forming a straight line along the lateral line, below which the ground color of the body fades away into a pale blue. Sepia brown blotches are found along the back. The ground colour of the dorsal half of the head is yellowish ochre as in the body with sepia brown markings on the dorsal part of the upper jaw, the space between the eyes and the neck. The ventral half of the head is of the same colour as of the body. The pupil of the eye indigo-black, surrounded by a ring of sky-blue colour. All the fins yellowish ochre, the terminal portion of the dorsal, the ventral and the anal, as well as the median portion of the caudal, of a lighter colour. A row of elongated black streaks on the upper third of the dorsal fin between the fin-rays.

Larger individuals of about 105 mm. were obtained in Matsubara. They are brown on the dorsal part of the head above the eyes, the greater part of the body and caudal fin. The sides of the head are bluish, and passes gradually to light crimson towards the ventral side. The lips are of a pale blue-colour; the pupil of the eye, black with a ring of a bright crimson. The dorsal third of the body darker brown with traces of indigo tint. The dorsal two-third of the body are covered with sepia coloured scales. The dorsal, the pectoral, the ventral and the anal fins are light brown, and with a light indigo-colour on the anterior parts of the dorsal and the ventral fins. The ventral and the anal

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1) JORDAN & FOWLER, 1903, Proc. U. S. Nat. Mus., vol. 26, no. 1334, p. 834.
2) ISHIKAWA 1895, Zool. Mag., vii, pp. 125–127.

fins also edged with a light indigo colour. The base third of the caudal fin with longitudinal streaks of a brown colour. This is known by the name of "Aburahae."

The largest specimens of this fish we got in Ôtsu were nearly 170 mm. in total length, and are again of a quite different colouration from either of the two preceding. The upper half of the body is deep indigo blue with darker-coloured scales scattered over it. The ventral half yellowish, becoming quite light on the ventrum, and with scales of golden yellow scattered all over. The ground colour of the head reddish yellow, the dorsal portion dirty green.

The pupil of the eye deep indigo, with crimson and indigo-coloured streaks around it. The dorsal and the caudal fins greenish ochre. The ventral and the anal white with yellow stripes."

Genus **Abbottina** JORDAN et FOWLER, 1903.

Abbottina JORDAN et FOWLER, 1903, Proc. Nat. Mus., vol. xxvi, no. 1334. p. 835.

Type = **Abbottina psegma**

Characters: Body elongate, oblong and compressed. Head elongate, pointed; snout elongate, compressed, concave above, and slightly produced, with the tip bluntly rounded; eye small, high, and midway in head; mouth small, inferior, protractile downward, and the maxillary not reaching eye; lips fleshy, not papillose; barbels moderate, one on each maxillary; teeth 5–5; interorbital space flat. Intestine short. Peritoneum silvery. Scales large, about 38, none on breast. Origin of dorsal nearer tip of snout than base of caudal, and inserted far behind base of last dorsal ray; caudal emarginate; ventral inserted a little behind the middle of the base of the dorsal.

Lateral line slightly decurved on the first 3 or 4 scales, after which it is straight and continuous. Dorsal and caudal with several dark, well-defined crossbars, as in *Pseudogobio*, which it resembles, but is easily distinguished by its smooth lips. Breeding males have the median rays enlarged, so that the fin is very large.

The present genus resembles *Pseudogobio*, except that the dorsal is high and convex in the adult. Dorsal and caudal are sharply barred, with a black spot in center of caudal base; sides with regular rows of dark specks.

49. **Abbottina rivularis** (BASILEWSKI).

"Tsuchifuki, Doromoroko, Sunamoroko"

(Text-figs. 71, a–b)

Abbottina psegma JORDAN et FOWLER, 1903, Proc. Nat. Mus., vol. xxvi,, no. 1334, pp. 835-837. – TANAKA, 1921, Nihon Gyogaku, p. 188. – MIYADI, 1935, Kyôto fuka Tansuigyorui, p. 29, pl. 2, fig. 2.

Abbottina rivularis BASILEWSKI, 1855, Nouv. Mem. Soc. Nat. Moscou, x, p. 231. – NICHOLS, 1943, Freshwater Fishes of China, p. 179.

Pseudogobio rivularis JORDAN et METZ, 1913, Mem. Carnegie Museum, vol. vi, no. 1, pp. 15–16.

The original description* is as follows:

Abbottina psegma JORDAN and FOWLER, new species.

Head, 3½; depth, 4⅓, D. II, 8; A. II, 8; P. I, 11; V. 8; scales 38 in the lateral line; 5 scales in an oblique series between the origin of the dorsal and about 6 between the latter and the middle of the belly; pharyngeal teeth 5-5; width of head 1¾ in its length; snout 2¼ in head; eye 5; interorbital space 3⅓; pectoral a little shorter than the head; ventral 1½.



Text-figs. 71. a-b. ***Abbottina rivularis*** (BASILEWSKY). ♂ × 1

Body elongate, oblong, moderately deep, and compressed. Head elongate, pointed, and compressed; snout elongate, compressed, concave above and slightly produced beyond the mandibles, the tip bluntly rounded; eye small, $2\,^1/_3$ in snout, high, and about midway in the length of the head; mouth small, inferior, and protractile downward, the maxillary reaching posteriorly beyond the nostrils, but not to the anterior margin of the eye; lips moderately broad, thick, and fleshy, but not covered with distinct papillae, as they are perfectly smooth; barbel short, thick, and about equal to two thirds the diameter of the eye; pharyngeal teeth small, weak, with a narrow grinding surface and slightly hooked; nostrils together, rather large, and nearer the eye than the tip of snout; interorbital space broad and flat, the top of the head also rather flat. Gill openings large, the gill membranes forming a rather fleshy flap on each side below; gill rakers short, weak, fleshy, and in moderate number; gill filaments long; pseudobranchiae well developed. Intestine with a single convolution. Peritoneum silvery.

Scales large and cycloid, none on the breast; no pectoral flap; ventral flap short.

Origin of the dorsal nearer the tip of the snout than the base of the caudal by the length of the snout, and the upper edge of the fin greatly convex on account of the great length of the median rays, so that when it is depressed it reaches posteriorly nearly to the base of the penultimate anal ray, and its length is equal to $2\,^2/_5$ in the body without caudal; origin of anal at about the last two-fifths of the space between origin of dorsal and base of caudal, and when depressed reaching about to the latter; caudal rather deeply emarginate, and the lobes pointed; pectoral long, the first rudimentary ray stout and strong, and the tip of the fin reaching beyond the origin of the dorsal, but not quite to the base of ventral; ventrals inserted a little nearer origin of anal than that of pectoral, and reaching for two-thirds the space to the former. Caudal peduncle rather short and compressed, its least depth $2\,^3/_5$ in head. Lateral line slightly decurved on the first 3 or 4 scales, after which it is straight and continuous.

Color in alcohol, dark , rich brown above, below whitish and silvery, and the sides and upper sur-

face speckled and spotted with dark brown, very distinct on the latter; dorsal and caudal with narrow, blackish cross-bars, the pectoral also with blackish spots above, and the ventrals and anal pale; axil of pectoral with a black spot; lips and barbels pale; length 4⅛ inches.

Type No. 7721, Ichthyological Collections, Leland Stanford Junior University Museum. Locality, Yodo River at Ôsaka in Settsu. Cotype No. 50765, United States National Museum and Nos. 7721, 7148, Leland Stanford Junior University.

We have many specimens from the Yodo River at Ôsaka in Settsu, the Chikugo River at Kurume, and the Iwai River in Rikuchû.

In non-breeding males, females, and young, the middle dorsal rays are not elongated, the upper edge of the fin being straight, and the sides are marked with rather large and distinct dark blotches.

Remarks: JORDAN and FOWLER* described the non-breeding males, females and young, provided with unelongated middle dorsal rays and with straight upper edge of the fin and the sides are marked with rather large and distinct dark blotches.

The present species is distributed far west from River Yodo, Ôsaka in Honshû and Kyûshû. Although recently it is breeding in the vicinity of Tôkyô, it may be introduced from Kansai together with *Gnathopogon elongatus elongatus*. They are dwelling on sandy and muddy sand bottom of calm waters and ponds as well as swamps. They are feeding on dottom animals and spawning from April to June.

Type locality: Yodo River at Ôsaka in Settsu.

Table 50. Measurements of *Abbottina rivularis* (BASILEWSKY).

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total length	83. 0mm.	Head/Interorbital width	2. 37
Body length	67. 0	Head/Diameter of Eye	2. 37
Body length/Head	3. 53	Head/Length of Caudal peduncle	1. 58
Body length/Depth	4. 47	Head/Depth of Caudal peduncle	2. 37
Body length/Predorsal length	2. 24	Head/Length of Dorsal fin	1. 73
Body length/Prepectoral length	3. 94	Head/Length of Anal fin	2. 71
Body length/Preventral length	2. 03	Head/Height of Dorsal fin	1. 06
Body length/Preanal length	1. 29	Head/Height of Anal fin	1. 58
Head/Snout	2. 11	Head/Pectoral length	1. 12
Head/Upper jaw	3. 16	Head/Ventral length	1. 74
Date	V, 1938		
Locality	Lake Biwa, Shiga Prefecture		

* Ôtsu Hydrobiological Station attached to Kyôto University.

Distribution: River Yodo, Ôsaka; River Chikugo, Kurume; River Iwai, Ichinoseki (JORDAN et FOWLER); River Yodo; Okayama Prefecture; Yanagawa, Kyushu (MIYAJI);

Genus Gnathopogon BLEEKER, 1860.

Gnathopogon BLEEKER, 1860, Ichth. Archipel. Indic. Prodr., ii, p. 434.

* JORDAN & FOWLER, 1903, Proc. U. S. Nat. Mus., vol. xxvi, no. 1334, p. 837.

Type species: – **Gnathopogon elongata.**

Characters: Body elongate, compressed. Snout depressed and without bony prominence in front; eyes superior, not covered with eye lids; jaws with thin and simple lips; maxillary oblique, ending before the eye; two maxillary barbels. Abdomen not keeled. Dorsal with few rays before ventrals and ending in front of anal; anal with few rays. Lateral line slightly decurved.

Key to the Japanese species of Gnathopogon

a¹. Anus not in advance of the normal position just before the anal fin. Eye small, usually less than one-fourth length of head. Pectoral fin usually reaching less than two-thirds the distance to with ventral insertion.

b¹. Snout narrower; maxillary reaching nearly or puite to below front of orbit. Pharyngeals 2 or 3 teeth in inner row.

c¹. Pharyngeal teeth smooth or obsolescently serrate on the grinding surface; barbel about as long as, or longer than pupil.

d¹. Barbel much longer than pupil (1.2 to 1.7 in eye). Origin of dorsal usually nearer base of caudal than tip of snout. Scales in four to five rows above and 34 to 39 rows along the lateral line.

d². Body rather robust, its depth 3.4 to 4.3 in standard length; caudal peduncle less than twice as long as deep, its depth 7.4 to 8.7 in body; width of body about 1.75 in its depth. Length of pectoral fin 1.4 to 1.7 in distance between insertions of paired fins. Color lighter; less spotted .... **G. elongatus elongatus**

d³. Body slenderer, its depth 4.0 to 4.7 in standard length; caudal peduncle about twice as long as deep, its depth 8.6 to 10 in body length; width of body about 1.5 in its depth. Length of pectoral fin 1.6 to 1.9 in distance between origin of paired fins. Color darker; more spotted .... **G. elongatus suwae**

cc. Pharyngeal teeth strongly dentate on grinding surface; barbel much shorter than pupil; body slender; origin of dorsal nearer tip of snout than base of caudal. Scales in 42 in rows to caudal base .... **G. elongatus caerulescence**

a². Anus in advance of normal position just before anal fin. Eye usually large, more than one-fourth length of head, except in large specimens of *G. japonicus*. Pectoral fin usually reaching more than two-third distance to ventral insertion. Origin of dorsal nearer tip of snout than base of caudal.

e¹. Distance from anus to anal fin less than length of eye.

f¹. Scales above lateral line in 2.5 to 3.5 rows; scales more or less enlarged lateral line in 3 or 3.5 rows; scales of mid-dorsal line little enlarged. Barbel about two-thirds as long as eye. Scales above lateral line in 3.5 rows; scales of mid-dorsal line moderately enlarge .... **G. gracilis**

f². Scales above lateral line in 4.5 or 5 rows; scales not enlarged along mid-dorsal line. Body with dark spots, inconspicuous; top of head not spotted. Barbel short, not reaching to below middle of pupil, 0.3 to 0.6 as long as eye. Eye about 4.0 shorter than snout, little more than half postorbital. Scales 35 to 37. .... **G. japonicus**

e². Distance from anus to anal fin at least as long, than diameter of the large eye. Depth of body 4.5 to 6.0 in length. Scales above laterall ine in 5 rows, along lateral line in 39 rows. Head less than one-fourth standard length. .... **G. biwae**

50. **Gnathopogon elongatus elongatus** (TEMMINCK et SCHLEGEL).

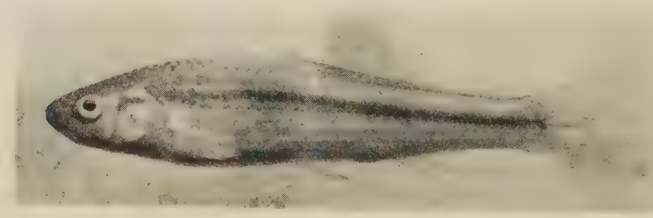
Minnow, "Moroko, Tamoroko"
(Text-figs. 72 a–b)

Capoeta elongata TEMMINCK et SCHLEGEL 1846, Fauna Japonica Poiss., p. 200, pl. C, fig. 1.

Gnathopogon elongatus BLEEKER, 1863, Ned. Tijdschr. Dierk., L, p. 202. - BLEEKER, 1879, Verh. Akad. Amsterdam, xviii, p. 23. – JORDAN et SNYDER, 1901, Proc. U. S. N. M., xxiii, p. 343. – JORDAN et SNYDER, 1901, Annot. Zool. Jap., iii, p. 47. –JORDAN et FOWLER, 1903, Proc. U. S. Nat. MUS., xxvi, pp. 822-823. – JORDAN, TANAKA et SNYDER, 1913, Journ. Coll. Sci., Tokyo, xxxiii, p. 66. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vi, pp. 215, 217. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 165. – TANAKA, 1921, Nihon Gyogaku, p. 184. – MIYADI, 1935, Kyôtofu Tansuigyo, p. 25, pl. 4, fig. 19. – MIYADI, 1935, Shinshû no Gyorui, pp. 217-218, figs. 115. – OKADA et NAKAMURA, 1948, Nihon Tansuigyo, pp. 160-161, fig. 82. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 131-133, Fig. 108.

Barbus homogenes GÜNTHER, 1868, Cat. Fish. Brit. Mus., vol. xvii, p. 136.

Leucogobio guentheri ISHIKAWA, 1901, Annot. Zool. Jap., iii, pp. 161-162 pl. 3, figs. la, lb, lc, ld. – JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., xxvi, p. 826. – BERG, 1906, Ann. Mag. Nat. Hist., (7) xviii, p. 395. – TANAKA, 1908, Annot. Zool. Jap., vii, p. 6. – TANAKA 1908, Zool. May., no. 237, p. 235.


a


b

Text-figs. 72. a. ***Gnathopogon elongata elongata*** (T. et SCH.). ×1
b. ***Gnathopogon elongata elongata*** (T. et SCH.). ×1

The original description* is as follows:

Capoeta elongata

Les voyageurs hollandais ont découvert dans les equx douces du Japon six petits Cyprinoides, qui tiennent des Ables (*Leuciscus*) par tous leurs caractères essentiels, mais qui s' en éloignent cependant par la présence d'un petit barbillon pendant de chaque côté de la commissure des lèvres. Ces poissons se rapprochant par ce caractère des *Capoètes* de Mr. DE VALENCIENNES, et s' éloignant ainsi que ces

Capoëtes par l' ensemble de leur organisation et leurs formes, des Goujons (*Gobio*) et des Tanches (*Tinca*), qui offrent ce même caractère, nous les avons rangés dans le genre *Capoeta*, observant toutefois qu'ils n' ont pas le grand rayon de la dorsale dente et qu'ils se rapprochent, tant par ce caractère nègatif que par leur physionomie, beaucoup plus des Ables que les *Capoetes* de Mr. De Valenciennes. Quelques espèces japonaises ètant même tellement voisines de certaines Ables qu'elles ne paraissent guère s'en distingure que par leur barillon, il est èvident que ce genre, tout en offrant l'avantage d'être basé sur un caractère tranchant, n'en est pas moins un des plus artificiels que l'on puisse imaginer. On doit par conséquent dire que les Capoètes du Japon sont des Ables purvus à l'angle de la bouche d'un petit barbillon. Quant à la forme du corps des espèces japonaises, elle varie considérablement suivant les espèces; car quelques unes ont le corps allongé et gros, tandis qu' il est très-comprimé et élevé dans d' autres et que d'autres encore sont intermédiaires sous ce rapport aux deux extrêmes que nous venons de citer. Rangeant les espèces suivant la forme du corps, nous commencons par celled qui, offrant les formes les plus allongées, se rapprochent à cet égard davantage des *Capoetes* de Mr. De Valenciennes pue toutes les autres spèces japonaises. Ce sont aussi ces mêmes motifs qui nous ont porté à attribuer à notre première espèce l' epithète latine d' *elongata*.

Nous possédons deux individus de ce petit poisson; l'un de trois pouces, et l'autre de trois pouces et demi de long. La grosseur du corps fait la moitié de sa hauteur, qui surpasse un peu la longueur de la tête et entre quatre fois dans la longueur comprise entre l'extrémité du museau et l'échancrure de la caudale. Le diamètre de l'aeil égale la longueur du museau, qui est quatre fois dans celle de la tête. L' entredeux des yeux est de moitié plus considérable que le diamètre de ces organes. Les orfices de la narine, seulement séparés par une mince cloison prolongée en un lobe qui recouvre l'orifice postérieur, s'ouvrent sur les côtés du des sous du museau, au milieu de la distance comprise entre l'intermaxillaire et les yeux. La bouche est peu spacieuse; elle s'étend jusqu' à l'extrémité du museau, mais le maxillaire ne se prolonge en arrière que sous l'aplomb de la fin du troisieme quart de la longueur du museau; sa fente forme avec l'axe longitudinal de corps un angle très-aigu. La longueur du barbillon que se trouve attaché près de l'angle formé par la jonction des bords inférieur et postérieur du maxillaire, n'excede guere la moitié du diamétre de l aeil. Le diamètre des sous-orbitaires égale le tiers de celui des yeux; mais la troisième de ces pièces est un peu plus large et presque du double plus longue que les autres. Les bords de l'opercule forment un angle un peu obtus et arrondi. Le dessus de la tête est arrondi vers les côtés; la ligne qui détermine cette partie est à-peu-près droite jusque sur le museau, ou elle devient un peu arquée. La ligne de démarcation entre la nuque et la tête est presque droite. Les téguments de la tete offrent une surface unie, meme sur les opercules. La ligne latérale, droite dans presque toute son étendue, monte par devant un peu vers le haut. Les écailles ont leur surface marquée de stries extremement fines, trèsserrées et un peu divergentes; on compte environ 38 ecaillessur la ligne latérale, et entre le ventre et le dos 13 rangées d'écailles, dont 5 se trouvent au dessus de la ligne laterale. L'anus s'ouvre tout près du commencement de l'anale, sur la fin du deuxième tiers de la distance comprise entre le bout du museau et la base de la caudale.

Les pectorales se trouvent placées sur la ligne tirée depuis l'angle de la bouche et parallèle a l'axe longitudinal du poisson; leur longueur égale celle de la tête sans le museau; leur extrémité est éloignée de la base des ventrales a une distance égalant la moitié de leur longueur. Les ventrales sont d'un cinquième plus courtes que les pectorales, et elles atteignent presque l'orifice de l'anus. L'anale, dont le bord inférieur est droit, est tant soit peu plus courte que les ventrales; elle est précédée d'une faible épine de moitié plus courte que le rayon très-grêle et flexible qui la suit, anquel elle est acollée et qui est aussi long que le premier rayon mou de cette nageoire. La caudale est échancree, ses lobes libres sont pointus et leur longueur occupe la moitié de la nageoire. La dorsale est un peu plus rapproché e la tête que les ventredales; sa forme et la nature du deuxieme et troisième des rayons indivisès sont absolument semblables au premier et deuxième des rayons de l' anale; mais cette nageoire dorsale est d'un tiers plus grande que l'anale. D. 3+7; A. 2+6; V. 2+7, et dont le dernier rayon est indivisé; P. 15; C. 19, outre les rayons lateraux accessoires.

* Temminck et Schlegel, 1846, Fauna Japonica Poisson, p. 200, pl. c, fig. 1.

Conservé dans la liqueur forte, le corps de ce poisson est d'un brun à reflets argentés, foncé sur le dos et pale sur le ventre. Une large raie mal déterminee d'un bleuâtre argenté s'étend le long des côtés du corps. Les opercules sont d'un blanc argenté très-pur, et les nageoires d'un jaunatre uniforme. Toutes les écailles se trouvent parsemées de points noirs excessivement petits.

Description: Head 3.4 to 4.0 in standard lnegth, and depth of body 3.4 to 4.3; D. III, 7; A. II, 6; P. 15: V. I, 7; about 34 to 39 scales on lateral line; 5 scales between the back and lateral line; diameter of eye equal to the length of snout, 4.2 to 5.0 in head, 1.2 to 1.7 times as long as barbel.

Head oblong, snout longer than eye which is about one-fifth of length of head and considerably more than one-half of width of interorbital space. Mouth slightly oblique, somewhat wider than long, its cleft very oblique, and extending nearly to the tip of snout; maxillary prolonged posteriorly for three-fourths length of snout; gill-rakers 6; teeth 5, 5–3, 5; diameter of the suborbitals equal third of the eye, but length of posterior nearly twice that of others; length of maxillary barbel scarcely exceeding half diameter of eye, nostrils only separated by a thin lobe which covers posterior orifice; opening upon lower sides of snout midway between inter-maxillary and eye; interorbital space considerably more than diameter of eye. The edge of opercle forms a somewhat obtuse and rounded angle. Upper part of head rounded upon sides; its upper profile straight until snout, which is somewhat convex. Line of demarcation between head and neck nearly straight; skin of head and opercle smooth. Scales with their surfaces marked with fine striae, very compact and somewhat divergent.

The origin of the dorsal fin is slightly before the ventrals and nearer to end of snout than to root of caudal; second and third rudimentary rays like the first and second of anal, but size of fins a third larger than latter; margin of anal straight, equals, or somewhat more than ventrals, and preceded by a weak spine less than half length of slender and flexible ray which follows, and which is also longer than first divided ray of fin; pectoral fin shorter than the head without snout, and nearly as long as distance from middle point of orbit to end of operculum, and terminates a long way from root of ventral fin; caudal fin deeply emarginate, lobes pointed, and their length about half fin; ventral fins slightly shorter than pectorals and almost reach anus. Anus entirely after origin of anal and about two-thirds of distance between tip of snout and base of caudal. Peritoneum black.

Coloration: Color in spirits brown above with silvery reflections, below pale; opercle pure silvery white and the fins uniform yellowish; scales sprinkled with numerous minute black dots; a broad and ill-defined band of bluish-silvery extending along the sides of the body. Dorsal fin with a narrow black streak between each rays.

Secondary sexual characters: Minute pearl organs appear on the snout, internasal space, interorbital space and head-top of the male.

Remarks: JORDAN and THOMPSON mentioned the specimens from Lake Biwa, described as *Leucogobio güntheri* by JORDAN and FOWLER, correspond entirely to Professor ISHIKAWA's account of the species. The *Capoeta elongata* of SCHLEGEL is certainly the

same, agreeing in the deep caudal peduncle and the short pectoral, not extending half way to ventrals. TANAKA included all six species of *Gnathopogon* found in Japan into present one species. *Gnathopogon elongatus.*

Habits: This fish likes to live in the middle layer of clear, shallow and steady water of rivers, ponds and swamps with sandy bottoms. The food is consisting chiefly of pelagic crustaceans, small aquatic insects and partly of water-weeds. The breeding season is in spring and the habits are nearly the same to those of *Gnathopogon elongatus caerulescens.* In Lake Biwa, they live in shallow water all their like and not migrate into so long distance. In the western part of Honshû, they are breeding in reservoirs together with *Cyprinus carpio* and *Carassius auratus*, and very easy to interbreed between this and other species of the genus. They are transplanted into Kantô districts from Lake Biwa and now in breeding in the ponds and swamps.

Distribution: This species is distributed far west of Shizuoka Prefecture on the Pacific coast and far west of Niigata Prefecture on the Japan Sea coast. Type locality: Streams about Nagasaki; On the Pacific coast – Karasaki, Lake Biwa (OTAKI); Lake Biwa, Matsubara; River Kawati, Nagoya; River Yodo, Ôsaka (JORDAN & THOMPSON); Lake Kawaguti; Mikawa Bay; Lake Biwa; River Yodo (ISHIKAWA); Himezi (ABE); Kumamoto, Kyûshû; Ôtu (WAKIYA); Nagasaki; Kumamoto, Kyûshû (JORDAN & HUBBS). River Ômoi, a branch of River Tone, Ibaraki Prefecture; Takamatsu, Kagawa Prefecture; Kawagoe; River Arakawa, Saitama Prefecture; Tôkyô; River Tone (AOYAGI); River Sagami; Okayama Prefecture; River Yura (TANAKA); River Tenryû; River, Ota; Lake Sanaru, Shizuoka Prefecture (OKANO); River Kiso, Aichi Prefecture (JORDAN, THOMPSON, NIWA); Kochi Prefecture (KAMOHARA); River Shinano, Niigata Prefecture; Lake Mikata, Fukui Prefecture (NAKAMURA, MINAKAWA); Nagasaki (TEMMINCK & SCHLEGEL); River Chikugo (JORDAN & FOWLER).

51. Gnathopogon elongatus caerulescens (SAUVAGE).

Willow-minnow, "Honmoroko, Yayoi-ugui, Yanagi-moroko"

(Text-figs. 73, a–b)

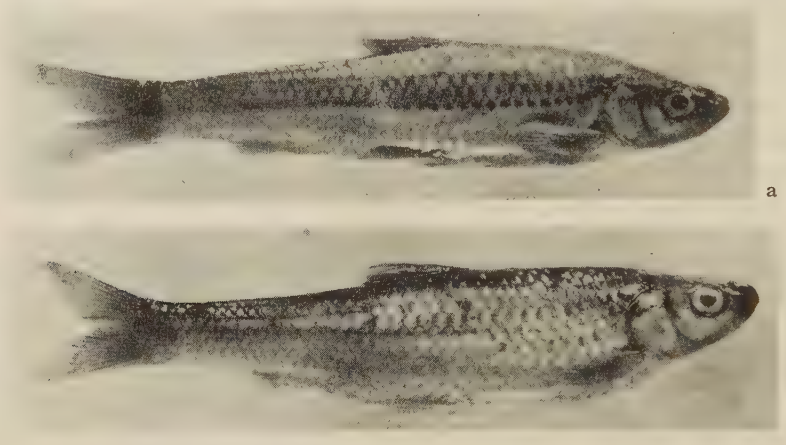
Squalius caerulescens SAUVAGE, 1993, Bull. Soc. Philom. Paris, p. 3.

Leuciscus caerulescens JORDAN et FOWLER, 1903, Proc. U. S. N. Mus., vol. xxvi, p. 845. – JORDAN et SEALE, 1906, Proc. U. S. N. Mus., vol. xxx, p. 144. – TANAKA, 1921, Nihon Gyogaku, p. 191.

Otakia rasborina JORDAN et SNYDER 1900, Proc. U. S. N. Mus., vol. xxiii p. 345, pl. 9, fig. 3. – JORDAN et SNYDER, 1901, Annot. Zool. Jap., iii, p. 46. – JORDAN et FOWLER 1903, Proc. U. S. N. Mus., vol. xxvi, pp. 842-843, fig. 6. – TANAKA, 1908, Zool. Mag., No. 237, p. 235. – JORDAN, TANAKA et SNYDER, 1913, Annot. Zool. Jap. xxxiii, p. 70, fig. 44.

Leucogobio jordani ISHIKAWA, 1901, Zool. Jap., iii, pp. 163-164, pl. 3, fig. 2. – JORDAN et FOWLER, 1903, Proc. U. S. N. M., xxvi, p. 827. – BERG, 1906, Ann. Mag. Nat. Hist., (7), xviii, p.395. – TANAKA, 1908, Zool. Mag., no. 237, p. 235. – TANAKA, 1908, Zool. Mag., no. vii, p. 5. – JORDAN, TANAKA et SNYDER, 1913, Journ. Coll. Sci. Tôkyô, xxxiii, p. 67.

Gnathopogon jordani JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, p. 217.
Gnathopogon caerulescens JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 167. – MIYADI, 1935, Kyôto-fu Tansuigyo, p. 25, pl. 4, fig. 20. – OKADA et NAKAMURA, 1948, Nihon Tansui Gyorui, pp. 159–160, fig. 81.
Richardsonius caerulescens JORDAN, TANAKA et SNYDER, 1913, Catal. Fish. Japan, p. 72.
Gnathopogon elongatus caerulescens AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish., pp. 133–134, fig. 109.



Text-figs. 73. a. ***Gnathopogon elongatus caerulescens*** (SAUVAGE). ♂ Lake Biwa.
b. ***Gnathopogon elongatus caerulescens*** (SAUVAGE). ♀ Lake Biwa.

The original description* is as follows:

Squalius caerulescens SAUVAGE 1883

D. 9; A.8; V. 8; L. lat. 45.

Hauter du corps égale à la longueur de la tête, contenue cing fois un quart dans la longueur totale. Museau un peu plus cort que le diametre de l'oeil, qui fait le quart de la longueur de la tête ; espace interorbitaire bombé, un peu plus large que la diametre de l' oeil; sous-orbitaires étroids; quelques pores au dessus due museau. Dorsale insérée un peu plus pres de l'extrémité du museau que de la base de la caudale, un peu en avant des ventrals; caudale échancrée. Ligne latérale drite. Dents pharyngiennes 5-2. Coloration argentée, rembrunie sur le dos et le dessus de la tête; une large bande blucatre le long de la ligne laterale. Longueur, O. 120.
Nom local: Morokko.

Description: Head 4; depth 4 4/5; D. 8; A. 7; scales 40–43 in a lateral series, 10 in a transverse series above ventral, and 17 between insertion of dorsal and occiput; eye 4 in head; snout $3\,^{1}/_{2}$; interorbital space $3\,^{1}/_{2}$; height of D. $5\,^{1}/_{5}$ in body; anal $7\,^{1}/_{2}$; caudal $3\,^{5}/_{6}$; pectoral 6; ventral $6\,^{2}/_{3}$.

Body elongate, its depth about twice that of caudal peduncle. Head elongate; eye large, nearer tip of snout than posteior edge of opercle, a distance equal to half its dia-

* SAUVAGE, 1883, Bulletin de la Société Philomathique de Paris, Seriè, Tome Septième, pp. 146–147.

meter; mouth very oblique, lower jaw included, the maxillary protractile, and not extending posteriorly to edge of orbit; no barbels, teeth slender, hooked and with a scarcely discernible grinding surface in two rows. Gill-rakers on first arch slender, long, pointed, and about 16 in number; pseudobranchial present. Air-bladder large, with a median constriction. Alimentary canal short. Peritoneum silvery. Scales large.

Dorsal inserted a little anterior to ventrals, anterior rays weak; 8 developed rays, first the longest and preceded by a shorter, slender, closely adnate, simple ray, other rays gradually shorter, and edge of fin concave giving a somewhat falcate appearance when depressed; anal similar in shape to dorsal, the first developed ray preceded by a weaker, simpler, adnate ray, the second ray the longest and the others shorter; caudal deeply notched, tips pointed; pectorals obtusely pointed; ventrals not reaching vent. Depth of caudal peduncle about 2 in depth of body. Lateral line extending along middle of body and caudal peduncle and straight, with the exception of a slight upper curve of anterior 4 or 5 scales.

Color light; a silver lateral band, and a faint dark spot at base of caudal; a narrow, dark median dorsal band extending from head to base of caudal; upper parts with minute dots, especially upon the edges of the scales; dorsal fin a little dusky, the others without color.

Table 51. Measurements of *Gnathopogon elongatus caerulescens* (SAUVAGE).

Collection	Fish. Mie Univ.*				
Total length	92. 0mm.	85. 0mm.	92. 0mm.	85. 0mm.	70. 0mm.
Body length	74. 1	70. 0	73. 6	69. 4	56. 5
Body length/Head	4. 15	4. 11	4. 20	3. 92	3. 98
Body length/Depth	5. 12	4. 93	5. 25	4. 53	4. 92
Body length/Predorsal length	2. 14	2. 26	2. 23	2. 14	2. 13
Body length/Prepectoral length	4. 53	4. 52	4. 33	4. 60	4. 52
Body length/Preventral length	2. 08	2. 15	2. 16	2. 07	2. 05
Body length/Preanal length	1. 44	1. 50	1. 47	1. 46	1. 41
Head/Snout	3. 75	3. 86	3. 58	4. 22	3. 48
Head/Upper jaw	5. 00	5. 15	4. 73	4. 78	4. 31
Head/Interorbital width	2. 69	2. 98	2. 83	2. 86	2. 73
Head/Diameter of Eye	3. 60	4. 25	3. 90	4. 43	3. 92
Head/Length of Caudal peduncle	1. 13	0. 99	0. 98	1. 14	1. 22
Head/Depth of Caudal peduncle	2. 68	2. 58	2. 50	2. 36	2. 36
Head/Length of Dorsal fin	1. 89	2. 00	2. 12	2. 33	2. 09
Head/Length of Anal fin	2. 69	2. 74	2. 92	3. 05	3. 74
Head/Height of Dorsal fin	1. 20	1. 31	1. 37	1. 22	1. 36
Head/Height of Anal fin	1. 84	2. 27	2. 02	1. 65	1. 95
Head/Pectoral length	1. 33	1. 42	1. 46	1. 43	1. 54
Head/Ventral length	1. 50	1. 61	1. 65	1. 72	1. 77
Date	27, V, 1955				
Locality	Lake Biwa, Shiga Prefecture				

* Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

Remarks: The present species is quite peculiar in Lake Biwa and is recently transplanted into other districts. The fish is living in the middle and lower layers of Lake Biwa, taking pelagic crustaceans and bottom small animals. In the spring they migrate

into shallow coast from the deep, making a large school and enter into the inner lakes and small streams for spawning. The eggs are deposited to the slender roots of willow and water plants. In July, the youngs descend into outer lake and in winter they make a large group in the deep bottom.

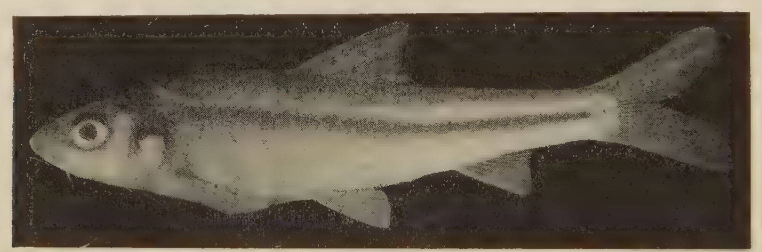
Type locality: Lake Biwa.

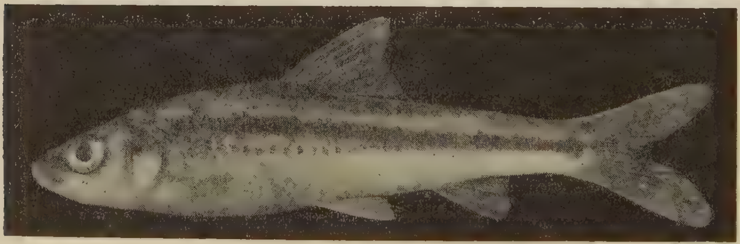
Distribution: Lake Biwa (WAKIYA, JORDAN, KAWAMURA); River Yodo, at Kyoto (JORDAN); Lake Biwa (SAUVAGE); Lake Biwa (OTAKI); Karasaki, Lake Biwa (JORDAN & SNYDER); Lake Biwa (ISHIKAWA); Kawatana near Nagasaki (JORDAN & SEALE); Lake Biwa (JORDAN, TANAKA & SNYDER); River Yodo, Kyôto, Lake Biwa (MIYADI); Lake Biwa (OKADA & NAKAMURA).

52. Gnathopogon japonicus (SAUVAGE).

Pop-eye minnow
"Hon-moroko, Deme-moroko"
(Text-figs. 74, a–b)

Squalius japonicus SAUVAGE, 1883, Bull. Soc. Philom., p. 4.
Leuciscus japonicus JORDAN et FOWLER, 1903, Proc. U. S. N. Mus., xxvi, p. 845.
Gobio mayedae JORDAN et SNYDER, 1900, Proc. U. S. N. Mus., xxiii, p. 342, pl. ix, fig. 2.


a


b

Text-fig. 74. a. ***Gnathopogon japonicus*** (SAUVAGE). Lake Biwa. ♂ ×1
b. ***Gnathopogon japonicus*** (SAUVAGE). Lake Biwa. ♀ ×1

Leucogobio mayedae JORDAN et FOWLER, 1903, Proc. U. S. N. Mus., xxvi, p. 828, fig. 3. – BERG, 1906, Ann. Mag. Nat. Hist., (7), xviii, p. 395. –SNYDER, 1912, Proc. U. S. N. Mus., xlii, p. 404. –TANAKA, 1908, Annot. Zool. Jap., vii, p. 5. –TANAKA, 1908, Zool. Mag., no. 237, p. 235. –JORDAN, TANAKA, & SNYDER, 1913, Journ. Coll. Sci., Tôkyô, xxxiii, p. 67, fig. 41.
Gnathopogon mayedae JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vi, pp. 215–217.

Gnathopogon japonicus JORDAN et HUBBS, 1925, Mem. Carn. Mus., x, no. 2, p. 171. – TANAKA, 1921, Nihon Gyogaku, p. 185, fig. 63. – MIYADI, 1935, Kyôto fuka no Tansuigyo, p. 25. – OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, p. 162, fig. 84.

Richardsonius japonicus JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Jap., p. 72.

Gnathopogon elongatus japonicus AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish., Jap. Arch., pp. 134–135, fig. 111.

The original description* is as follows:

Squalius japonicus SAUVAGE 1883

D. 9; A. 8; V. 8; L. lat. 38.

Hauteur du corps cing fois et demie, longueur de la tête quatre fois deux tiers dans la longueur totale. Museau a peine plus long que l'oeil dont le diametre est contenu trois fois et demie dans la longueur de la tête; espace interorbitaire plat, un peu moins large que le diamètre de l'oeil; sousorbitaires étroits; pas de pores au museau. Dents pharyngiennes 5–3. Dorsale inseree un peu plus pres de l'extretite du museau que du pedicule caudal, un peu en avant des ventrales; caudalee chancree. Ligne laterale droite. Couleur argentee; des points noirs le long du dos et sur chaque ecaille de la ligne laterale. Longueur, 0.085.

Nom local: *Ounagi.*

Description: Head $4\,^1/_2$; depth $4\,^1/_3$; D. III, 7; A. III, 6; P. 16; V. 8; scales in lateral line 37–39; 5 scales between the origin of dorsal and lateral line, and 6 scales between the latter and the middle of the belly; pharyngeal teeth 5, 3–3, 5; width of head a little less than 2 in its length; snout $3\,^3/_4$ in head; eye 4; interorbital space $3\,^1/_2$; pectoral $1\,^2/_5$; ventral $1\,^1/_2$.

Body elongate, oblong and compressed. Head elongate, compressed; snout rather bluntly rounded, and a trifle longer than eye; eyes moderate, anterior; mouth oblique, protractile, jaws about equal and maxillary not reaching to the front of eye; lips somewhat fleshy; a small maxillary barbel; pharyngeal teeth in larger row with narrow grinding surface, and some of them slightly hooked; nostrils close together, in front of eye above and also a little before end of maxillary; interorbital space broad and slightly convex. Gill openings large and membrane rather broadly joined to isthmus; gill-rakers short, few, and weak; pseudobranchiae large; gill-filaments rather long. Intestine short. Peritoneum silvery.

Scales rather large, of more or less uniform size, and cycloid; head naked; no pectoral flap and ventrals with a well-developed flap.

Origin of dorsal much in advance of middle of body without caudal, and tip of first developed ray reaching as far posteriorly as tip of last when fin is depressed; origin of anal entirely behind dorsal and when fin is depressed it does not reach quite half distance to base of caudal; caudal deeply emarginate, and the lobes pointed; pectoral falling rather in front of the origin of dorsal, and about three-fifths of space to ventrals.

* SAUVAGE, 1883, Bulletin de la Societe Philomathique de Paris, Septieme Serie, Tome Septieme, pp. 147–148.

Caudal peduncle compressed, rather long, and its least depth $2\,^1/_3$ in head. Lateral line continuous along the sides, and almost straight.

Table 52. Measurements of *Gnathopogon japonicus* (SAUVAGE).

Collection	O. H. B. S.*	
Total length	110. 0mm.	128. 0mm.
Body length	90. 0	106. 0
Body length/Head	3. 75	4. 25
Body length/Depth	4. 50	4. 08
Body length/Predorsal length	2. 20	2. 31
Body length/Prepectoral length	3. 91	4. 62
Body length/Preventral length	2. 00	2. 04
Body length/Preanal length	1. 38	1. 42
Head/Snout	3. 00	3. 34
Head/Upper jaw	2. 67	3. 12
Heab/Interorbital width	4. 00	3. 57
Head/Diameter of Eye	3. 43	4. 16
Head/Length of Caudal peduncle	1. 20	1. 00
Head/Depth of Caudal peduncle	2. 67	2. 50
Head/Length of Dorsal fin	2. 40	2. 08
Head/Length of Anal fin	3. 00	2. 78
Head/Height of Dorsal fin	1. 55	1. 39
Head/Height of Anal fin	1. 85	1. 92
Head/Pectoral length	1. 50	1. 47
Head/Ventral length	1. 60	1. 67
Locality	Lake Biwa, Shiga Prefecture	

* Ôtsu Hydrobiological Station, at Ôtsu, attached to Kyôto University.

Color in alcohol brown, pale or whitish below, and the body more or less silvery on the sides and lower parts; a pale longitudinal band, becoming darker along the caudal peduncle; along the sides; fins tinted with brown, except the ventrals and anal, which are pale like the lower surface.

Habits: In Lake Biwa, the present species lives in group on the bottom, less than 30 fms. In March, they close to along the coast and come into the inland Bay "Matsubara Naiko" and deposit eggs on weeds during the end of April and June. The food is consisting of pelagic crustaceans, aquatic insects.

Remarks: These fishes are dwelling in shallow waters with sand or muddy sand bottom and also in the bottom of inner lakes of Biwa lake. In winter they go down 40–60 m. deep bottoms. They feed on bottom animals. During May and June, they deposit the discoidal eggs, measured $1.25 \times 1.21 \times 0.75$ mm. in size.

Type locality: Lake Biwa.

Distribution: Karasaki, Lake Biwa (JORDAN & SNYDER); Matsubara, Lake Biwa; Zeze, the River Yodo, Osaka; River Chikugo, Kurume, Nagoya (JORDAN & FOWLER); River Kachi, Nagoya (JORDAN & HUBBS); Lake Biwa (WAKIYA); River Yodo, Lake Biwa; River Ibi, Gifu; Kawagoe, Mie-gun, Mie Prefecture (OKADA & NAKAMURA); Lake Biwa (SAUVAGE, JORDAN, SNYDER, TANAKA); River Kiso (JORDAN, HUBBS, NI-

WA); Yamaguchi Prefecture (SNYDER); River Yoshino, Tokushima Prefecture (TANAKA, KASAI).

53. **Gnathopogon biwae** (JORDAN et SNYDER).

"Sugo-moroko, Biwa-moroko"

(Text-figs. 75, a–c)

Gobio biwae JORDAN et SNYDER 1900, Proc. U. S. N. Mus., xxiii, p. 340, pl. 9, fig. 1. – JORDAN et SNYDER, 1901, Annot. Zool. Jap., p. 46.

Leucogobio biwae JORDAN et FOWLER 1903, Proc. U. S. N. Mus., xxvi, p. 829, fig. 4. – BERG, 1906, Ann. Mag. Nat. Hist., (7), xviii, p. 395. – TANAKA, 1908, Zool. Mag., no. 237, p. 235. – JORDAN, TANAKA et SNYDER, 1913, Jour. Coll. Sci. Tokyô, xxxiii, p. 68, fig. 42.

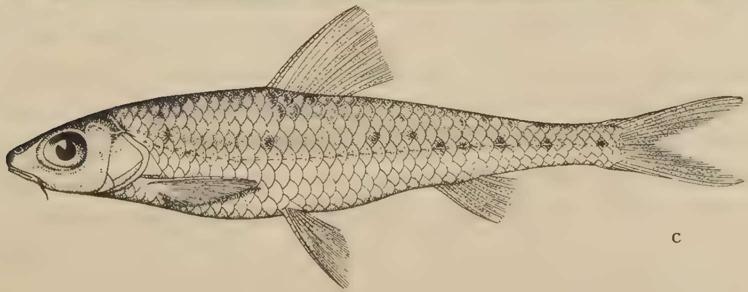
Gnathopogon gracilis JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vi, pp. 214, 217, fig. 3.

Gnathopogon biwae JORDAN et HUBBS 1925, Mem. Carn. Mus., vol. x, no. 2, pp. 171–172. – OKADA, MATSUBARA et UCHIDA, 1935, Nihon Gyorui Zusetsu, p. 81, pl. 26, fig. 3. – OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, pp. 162–163, figs. 85. – NIWA, 1954, Fishes of Kiso Valley, p. 239, p. 277.



a

b



c

Text-figs. 75. a. ***Gnathopogon biwae*** (JORDAN et SNYDER). Lake Biwa. ♂
b. ***Gnathopogon biwae*** (JORDAN et SNYDER). Lake Biwa. ♀
c. ***Gnathopogon biwae*** (JORDAN et SNYDER). Lake Biwa. ♂

The original description* is as follows:

Gobio biwae JORDAN et SNYDER

Type specimen. – No. 49399, U. S. N. M.

Locality. – Lake Biwa, Japan, near Matsubara, Collector, C. ISHIKAWA.

Description. – Head, $4\,^1/_3$ in length; depth, $4\,^1/_2$; depth of caudal peduncle, 3 in head; eye, 3; snout $3\,^1/_3$; interorbital space, $4\,^1/_3$; height of dorsal, 5 in length; anal, 9; length of pectoral, $5\,^1/_2$; ventral, $6\,^2/_3$; caudal, $3\,^5/_6$; number of dorsal rays, 8; anal, 7; scales in lateral series, 39; in transverse series, counting upward and forward from origin of ventral 9.

Body oblong; the dorsal, ventral and lateral contours sloping gradually and evenly from the region of the dorsal to base of caudal; anterior dorsal and ventral outlines evenly curved. Interorbital space flat. Eye very large; high in head; a little nearer tip of snout than edge of opercle. Snout shorter than longitudinal diameter of eye. Mouth inferior, oblique; lips rather thick; maxillary freely protractile; extending posteriorly not quite to a vertical from anterior edge of orbit; barbels, 2, on anterior edge of maxillary just above the distal end; equal to maxillary in length. Gill rakers on first arch few and far apart; reduced to mere elevations. Pseudobranchiae present. Teeth, 3.5–5.3: those of the first row slender and loosely attached; those of the main row high; hooked; with a narrow grinding surface. Alimentary canal short. Peritoneum with a little dusty coloring. Head naked; body covered with large scales. Lateral line slightly decurved; extending along the middle of body and caudal peduncle. First fully developed ray of dorsal longest; in the folded fin extending a little beyond tip of last ray; preceded by two small and closely apposed spine-like rays; following rays successively shorter; edge of fin concave. Anal similar to dorsal, except that in the folded fin the first ray does not quite reach tip of last, and the edge of fin is straight. Ventrals inserted below base of third dorsal ray; their edges rounded. Pectoral pointed. Caudal deeply notched; the tips pointed. Upper part of head and body above lateral line finely dotted with black; with dots usually grouped on edges of scales and clustered in small spots along the lateral line; a median dark band containing a few spots of deeper color extending along the body just above the lateral line. All the fins, except ventrals, with a little dark color.

The collection contains 2 other specimens (cotypes No. 6273 D. S. JORDAN. Univ. Mus.), which show no great variations in shape or color.

This species is easily distinguished from *G. mayedae* by its much more elongate body and darker color.

Type locality: Lake Biwa.

Distribution: Lake Biwa (JORDAN & SNYDER); Lake Biwa (JORDAN & THOMPSON).

Description: Head 4; depth about 6; D. III, 7; A. III, 6; P. 17; V. 8; scales 39 in the lateral line; 4 scales between origin of dorsal and lateral line, and 6 scales between the latter and middle of belly; pharyngeal teeth 5, 3–3, 5; width of head 2 in its length; eye a little over 3; interorbital space $4\,^1/_4$; pectoral $1\,^1/_3$; ventral $1\,^1/_2$.

Body elongate, rather slender and compressed. Head elongate, compressed, and somewhat pointed in front; snout rather long, bluntly rounded, and a little shorter than eye; eyes large, lateral and anterior; mouth oblique, inferior, protractile, jaws equal, and maxillary reaching almost to front of eye; jaws meet about level with the lower margin of the eye; lips somewhat fleshy; a maxillary barbel equal to about two-thirds the orbit; several pharyngeal teeth in the larger row with narrow grinding surfaces; nostrils together and near front of eye; interorbital space broad and flattened. Gill

* JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., xxiii, p. 340.

openings large; gill-rakers short, few, and weak; pseudobranchiae well-developed; gill filaments rather long. Intestine short. Peritoneum with a little dusty coloring.

Scales rather large, of more or less uniform size, and cycloid; head naked; no pectoral flap; ventral flap small.

Origin of dorsal much in advance of the middle of the body without caudal, and tip of the first developed ray reaching as far posteriorly as tip of last when fin is depressed; origin of anal behind tip of depressed dorsal a trifle nearer the origin of the ventral than base of caudal, and the fin reaching about halfway in the space between them; caudal deeply emarginate and the lobes pointed; pectoral reaching almost to the origin of dorsal and about three fifths in space to anal. Caudal peduncle compressed, rather long, and its least depth about equal to eye. Lateral line continuous along sides, very slightly decurved in front.

Table 53. Measurements of *Gnathopogon biwae* (JORDAN et SNYDER).

Collection	O. H. B. S.*	
Total length	103. 0 mm.	92. 0 mm.
Body length	85. 0	79. 0
Body length/Head	3. 14	3. 76
Body length/Depth	4. 47	5. 27
Body length/Predorsal length	1. 70	2. 20
Body length/Prepectoral length	3. 87	3. 76
Body length/Preventral length	2. 02	2. 08
Body length Preanal length	1. 44	1. 65
Head/Snout	3. 00	3. 00
Head/Upper jaw	3. 18	2. 62
Head/Interorbital width	4. 50	4. 20
Head/Diameter of Eye	3. 86	3. 50
Head/Length of caudal peduncle	1. 50	1. 40
Head/Depth of Caudal peduncle	3. 38	3. 00
Head/Length of Dorsal fin	2. 08	1. 75
Head/Length of Anal fin	3. 86	3. 00
Head/Height of Dorsal fin	1. 50	1. 31
Head/Height of Anal fin	2. 08	2. 10
Head/Pectoral length	1. 69	1. 40
Head/Ventral length	2. 08	1. 93
Date	VII, 1920	
Locality	Ôtsu, Shiga Prefecture	

* Ôtsu Hydrobiological Station, at Ôtsu attached to Kyôto University.

Color, in alcohol, brown, pale or whitish washed with silvery below; above the lateral line and upon the upper surface of the head with fine black dots grouped together on the edges of the scales in small spots and distributed irregularly; lateral line with a row of dark spots; a median lateral pale brown longitudinal band; all fins except ventrals with some dark color.

Remarks: Although the present species had been found mostly in Lake Biwa, now NIWA reported from River Kiso, Gifu Prefecture. They are dwelling in sandy and mud-sandy bottoms of Lake Biwa, feeding on bottom small animals, especially small

gastropods. The spawning season is June. Eggs are nearly discoidal, measuring 1.20–1.28 mm. in size.

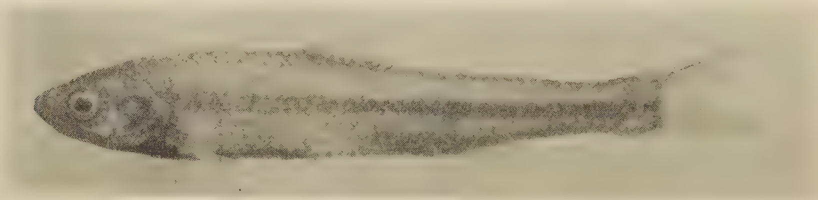
Type locality: Lake Biwa, near Matsubara.

Distribution: Lake Biwa (JORDAN & HUBBS); Lake Biwa (OKADA, MATSUBARA, UCHIDA); Lake Biwa (JORDAN & SNYDER).

54. Gnathopogon gracilis (TEMMINCK et SCHLEGEL).

Slim Minnow, "Sugo-moroko, Itomoroko"
(Text-fig. 76)

Capoeta gracilis TEMMINCK et SCHLEGEL, 1846, Fauna Japonica, Poiss., p. 201, pl. 100, fig. 2.
Gnathopogon gracilis BLEEKER, 1879, Verh. Akad. Amsterdam, xviii, p. 23. – JORDAN et FOWLER, 1903, Proc. Nat. Mus, xxvi, p. 823. – TANAKA, 1921, Nihon Gyogaku, p. 185. – JORDAN, TANAKA et SNYDER, 1913, Catal. Fish. Japan, p. 66. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., pp. 168–169. – MIYADI, 1935, Kyôtofu Tansuigyo, p. 25. – OKADA et NAKAMURA, 1948, Nihon Tansuigyo, pp, 161–162, fig. 83.
Gnathopogon ishikawae JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vi, pp. 215–217, pl. xxiv, fig. 4.
Barbus homozonus GÜNTHER, 1868, Cat. Fishes Brit. Mus., vii, p. 137.
Leucogobio mayedae JORDAN et SNYDER, 1900, Proc. Nat. Mus., vol. xxiii, no. 1213, pp. 342–343, pl. IX, fig. 2. – JORDAN et FOWLER, 1903, Proc. Nat. Mus., xxvi, p. 828. – JORDAN, TANAKA, SNYDER, 1913, Journ. Coll. Sci., Tôkyô, xxxiii, p. 67.
Gnathopogon elongatus gracilis AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., p. 134, fig. 110.



Text-fig. 76. ***Gnathopogon gracilis*** (TEMM. et SCH.).

The original description* is as follows:

Capoeta gracilis

Pl. C, fig. 2.

N'ayant recu qu'un seul individu de cette espèce, et cet individu ne se prêtant guère, à cause de sa petite taille qui n'est que de deux pouces et demi, à un examen minutieux, nous n'avons pas cru devoir placer cette espece à la tête du genre, quoiqu'elle offre des formed plus grêles qu'aucune des autrese spèces japonaises. Comme elle ressemble du reste sous beaucoup de rapports à la précédente, il suffira, pour s'en faire une idée précise, d'en indiquer les traits distinctifs, qui sont en effet nombreux et faciles à saisir.

*TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poisson., p. 196.

Nons constaterons d'abord que cette espèce offre des formes un peu plus allongées, la hauteur du corps étant cinq fois et demie dans la longueur comprise entre l'extrémité du museau et l'échancrure de la caudale; aussi le corps en arriere de la dorsale est-il, proportions gardées, plus grêle. La tête offre un aspect assez divers; car elle est un peu plus longue, les yeux sont beaucoup plus grands, le museau est plus gros et plus voûté en dessus et la ligne de la bouche est plus horizontale. On remarque ensuite que cette espèce a des sous-orbitaires beaucoup plus étroits que la précédente, que ses barbillons sont un peu plus longs, que ses pectorales plus allongées s'étent jusqu'à la base des pectorales, que sa ligne latérale forme par devant une courbure à peine sensible, que son anus est plus éloignèe de l'anale, et que ses écailles sont un peu plus grandes, ce qui fait que l'on en compte seulement trente-cinq sur la ligne latérale, quatre rangées entre cette ligne et le dos, et cinq rangèes entre cette ligne et le ventre. La forme des nageoires et le nombre de leurs rayons' les teintes et tous les autres dètails, sont comme dans l'espéce prècèdente.

Description: Head 3.14 in length of body to base of caudal; depth equal to head; D. III, 7; A. II, 6; scales in lateral line 25; in transverse series between insertions of vertical fins 3.5–2.5; pharyngeal teeth 5, 2–2, 5.

Body elongate and posterior to dorsal, slender. Head longer; snout bulky, convex above, slightly longer than eye; tip of premaxillaries at or below, level of lower margin of orbit; mouth cleft horizontal; barbel long, one-half to two-thirds diameter of eye, its base under the posterior nostril; maxillary ending under the anterior margin of the eye; gill-rakers very short and soft; pharyngeal teeth smooth, unserrated, a grinding surface present; depth of body $5^1/_2$ in the length between tip of snout and emargination of caudal.

Dorsal inserted, nearer the snout than the base of the caudal by the legth of the former; its margin straight, the first branched ray the longest; anal inserted under twenty-second scale of lateral line and beyond tip of dorsal rays, its margin straight; pectorals very long extending more than two-thirds of the distance to the base of the ventrals, reaching nearly to the base of the ventrals, ventrals reaching anus, their length less than that of pectorals by half diameter of pupil, anus removed from the first anal ray by two-thirds diameter of eye, and by two and one-half scales; caudal nearly equal to

Table 54. Measurements of *Gnathopogon gracilis* (TEMMINCK et SCHLEGEL).

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total length	63.0mm.	Head/Interorbital width	3.25mm.
Body length	44.0	Head/Diameter of Eye	3.25
Body length/Head	3.38	Head/Length of Caudal peduncle	1.17
Body length/Depth	3.66	Head/Depth or Caudal peduncle	2.36
Body length/Predorsal length	1.83	Head/Length of Dorsal fin	1.86
Body length/Prepectoral length	3.68	Head/Length of Anal fin	1.62
Body length/Preventral length	1.76	Head/Height of Dorsal fin	1.18
Body length/Preanal length	1.71	Head/Height of Anal fin	1.62
Head/Snout	2.34	Head/Pectoral length	1.18
Head/Upper jaw	3.25	Head/Ventral length	1.45
Date	1924		
Locality	Yanagawa, Fukuoka Prefecture		

* Ôtsu Hydrobiological Station, at Ôtsu, attached to Kyôto University.

lenght of head.

Scales much larger, 25 in lateral line; 4 rows of scales between lateral line and back and 5 rows between former and abdomen. Lateral line but slightly decurved, complete; scales of middle line of back much enlarged.

A spot of dark is located at the base of the first dorsal rays; space above lateral line with irregular spots, scales of lateral line pigmented where overlapped by the preceding scales; an indistinct dark line or stripe along side behind dorsal, continued anteriorly in an unpigmented space; caudal spot lacking. Peritoneum silvery, with small spots of black.

Remarks: As to the relation to *Gnathopogon ishikawae* and *Gobio biwae*, JORDAN and HUBBS* remarked as follows: "It appears almost certain to us that *Gnathopogon ishikawae* JORDAN and THOMPSON, rather than *Gobio biwae* JORDAN and SNYDER, is identical with *Capoeta gracilis* TEMMINCK et SCHLEGEL. The figure of *G. gracilis* indicates a fish differing from *G. biwae* in the lesser distance between anus and origin of anal fin; the deeper body, more elevated anteriorly, in the larger scales, etc. In these and other respects, except the height of the anal fin, which we find variable, with figure agrees with that of *G. ishikawae*. Moreover the type-localities of *G. gracilis* and *G. ishikawae* are in close proximity, while *G. biwae* has only been taken in Lake Biwa, far to the northward."

Type locality: Streams about Nagasaki.

Distribution: Lake Biwa (JORDAN & HUBBS); River Chikugo, Kurume, Kyûshû (JORDAN & THOMPSON); Nagasaki (TEMMINCK & SCHLEGEL); River Kitsu (NARA, SAWADA); Lake Biwa; River Yodo (MIYADI); Southern Japan; Rivers in Sanyô and Shikoku faced to Seto Inland water (OKADA & NAKAMURA); Lake Biwa, Matsubara (JORDAN & THOMPSON).

Genus Pseudogobio BLEEKER, 1863.

Pseudogobio BLEEKR, 1863, Atlas Ichthyol., p. 29.

Type = **Pseudogobio esocinus**

Characters: Body elongate, rather slender and tapering behind. Head elongate, pointed; snout long, concave above, and slightly produced, with its tip bluntly rounded; eye small, nearer posterior edge of opercle than tip of snout; mouth small, inferior, protractile downwards, the maxillary not reaching nostrils; lips broad, fleshy, and covered with well developed papillae; a rather short, thick, maxillary barbel; pharyngeal teeth small, 6 or 5, 2–2, 5 or 6, hooked at the end; interorbital space broad and concave. Gill-rakers rudimentary; pseudobranchiae very small. Intestine short. Peritoneum sivlery. Scales moderate, cycloid, about 42. Origin of dorsal nearer tip of snout than base of caudal; origin of anal far behind tip of depressed ventral; caudal emarginate; ventrals inserted well behind origin of dorsal. Lateral line almost straight or very slightly decurved and continuous. Dorsal and caudal with distinct narrow blackish cross-bands.

*JORDAN & HUBBS, 1925, p. 167.

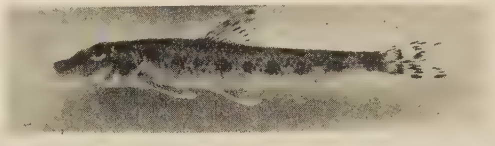
55. **Pseudogobio esocinus** (TEMMINCK et SCHLEGEL).

"Kamatsuka"

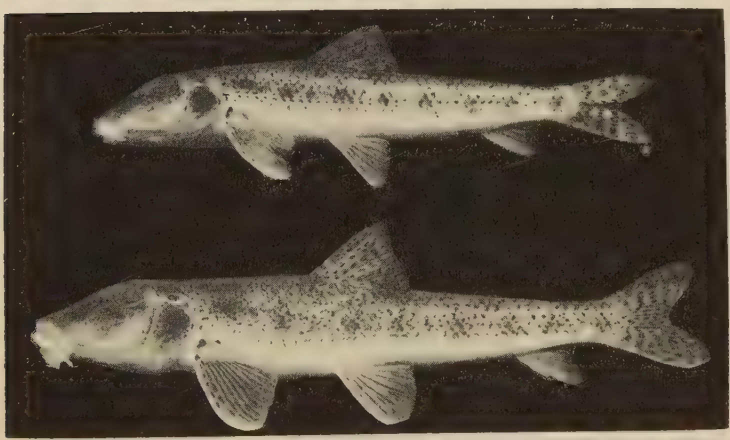
(Text-figs. 77, a–b)

Gobio esocinus TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poiss., p. 196, pl. xcix, fig. 2.

Pseudogobio esocinus GÜNTHER, 1868, Cat. Fish. Brit. Mus., vii, p. 175. – SAUVAGE, 1883, Bull. Soc. Philom., Paris, p. 3. – ISHIKAWA, 1895, Zool. Mag., vol. vii, p. 125. – ISHIKAWA, 1897, Prel. Cat., p. 15. – JORDAN et SNYDER, 1901, Prel. Check list Fishes of Japan, p. 46. – JORDAN et FOWLER, 1903, Proc. Nat. Mus., vol. xxvi, no. 1334, pp. 831-832. – TANAKA, 1911, Fishes of Japan, pp. 157–160, pl. XLII, fig. 165; pl. XLIII, fig. 171; pl. XLIV, fig. 172. – JORDAN et Metz, 1913, Mem. Carn. Mus., vol. vi, no. 1, p. 15. – JORDAN, TANAKA et SNYDER, 1913, Fishes of Japan, p. 68. – TANAKA, 1921, Nihon Gyogaku, pp. 186–187. – UI, 1932, Kishû Gyofu, p. 31. – MIYADI, 1935, Shinshû no Gyorui, pp. 218–219, fig. 117. - MIYADI, 1935, Kyoto fuka no Tansuigyorui, pp. 27–29, pl. 4, figs. 27, 27a. -OKADA, MATSUBARA et UCHIDA, 1935, Nihon Gyorui Zusetsu, p. 84, pl. 29, fig. 3. -OKADA et NAKAMURA, 1948, Nihon no Tansuigyo, pp. 163–164, fig. 86. - NIWA, 1954, Fishes of Kiso Valley, pp. 112–116, fig. 12. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 136–137, figs. 112–114.



a



a

b

Text-figs. 77. a. Young of ***Pseudogobio esocinus*** (TEMMINCK et SCHLEGEL).
b. ***Pseudogobio esocinus*** (TEMMINCK et SCHLEGEL). ♂
c. ***Pseudogobio esocinus*** (TEMMINCK et SCHLEGEL). ♀
after M. NAKAMURA

The original description* is as follows:

Gobio esocinus

PL. XCIX, fig. 2.

En mettant ce poisson curieux à côté du Goujon d'Europe, on n'hésitera pas un instant à rapporter ces deux espèces qui se ressemblent beaucoup par l'ensemble de leurs, à un même genre ; mais un exa-

* TEMMINCK et SCHLEGEL, 1846. Fauna Japonica Poisson, p. 196.

men détaillé de ces poissons fait ressortir des différences d'organisation assez sensibles, pour justifier leur séparation générique aux yeux de cretains naturalistes qui, sans cesse occupés à multiplier outre mesure le nombre des groupes, ne paraissent guère se rendre compte de la désolation qu'ils portent dans l'ame du naturaliste qui vise à un but plus élevé qu'à la connaissance spéciale de quelques familles du règne animal. Ce Goujon du Japon est en effet très-remarquable par la position avancée de son anus; par ses lèvres charnues, un peu frangées et prolongées en lobes pendants, caractère qui rapproche ce poisson des Labéons; par ses sous-orbitaires extrêmement développés; enfin, par son museau allongé, gros, un peu retroussé par devant, et offrant certaine analogie avec la tête du brochet, analogie à la quelle nous avons fait allusion par le choix de l'épithete que nous conférons à ce poisson. Les galeries du Musée en renferment une dizaine d'individus, dont la longueur varie de trois pocues et demi à sept pouces et trois quarts.

Cette espèce offre des formes plus allongées et plus grêles que le Goujon commun d'Europe. La grosseur du corps près du commencement de la dorsale est une fois et demie dans la hauteur du poisson, laquelle est cinq fois et demie à six fois dans la distance comprise entre l'extremité du museau et l'échancrure de la caudale. La tête entre trois fois et trois quarts dans la distance que nous venons d'indiquer, et le museau occupe presque la moitié de la longueur de la tête. L'entredeux des yeux égale à peu de chose près leur diamètre, qui est deux fois et un tiers dans la longueur du museau.

Les yeux sont tout à fait rapprochés du sommet de la tête et tant soit peu dirigés vers le haut. L'entre-deux des yeux est assez concave, et cette concavité se prolonge aussi sur l'occiput est séparé de la nuque par une ligne, qu milieu un peu saillante en angle, et faibleemnt courbée vers les côtés de la tête. Les os du front, en descendant sur la base du museau, s'y prolongent en une saillie en forme de pentagone de la longueur du diamètre de l'aeil et plane en dessus. En avant et sur les côtés de cette saillie, le museau se trouve un peu excavé; mais vers le devant il devient assez gros, arrondi de tous cotes et meme un peu retrousse. La bouche s'ouvre sur le dessous du museau, près de son extréimté; sa fente est presque horizontale, et elle est assez étroite; la fin du maxillaire n'atteint guère jusque sous l'aplomb de la fin du deuxième tiers de la longueur du museau. Le barbillon se trouve placé en bas près de la fin du maxillaire; sa longueur surpasse un peu le diamètre de l'aeil. Le maxillaire est simplement revêtu d'une peau semblable à celle des autres parties de la tête. La peau, au contraire, qui revêt l'inter-maxillaire est plus charnue, et elle forme un voile pendant, faiblement crénelé, au bourd, de la largeur du maxillaire, et qui entoure tout le bord inféieur de l'inter-maxillaire. La mâchoire inférieure est munie d'une double lèvre pendante et crénelée au bord, savoir une premiere lèvre plus petite et garnissant seulement le bord antérieur de cet os et une deuxieme divisée en trois lobes, et entourant cet os dans toute son etendue. Le premier sous-orbitaire est de forme deltoide et tellement large qu'il occupe presque à lui seul les côtés de la moitie antérieure du museau, et que le maxillaire se trouve en grande partie caché sous cet os, lorsque la bouche est fermée. Le deuxième sous-orbitaire est encore assez grand et en forme de parallélogramme, dont le diamètre vertical est d'un tiers moins considérable que le diamètre horizontal. Les autres sous-orbitaires sont au contraire petits et étroits. Le bord du préopercule forme un angle un peu obtus et arrondi; les bords de l'opercule et du sous-opercule forment une ligne continue et assez réguliérement arquée. Les os de la tête offrent tous une surface plus ou moins unie, à lexception des occipitaux, dont la surface est assez regueuse; la peau dont la tête est revetue n'offre nulle part des traces d'écailles. La poitrine est également revêtue d'une peau nue, qui se prolonge jusqu'à la fin de la base des pectorales. Les écailles du corps sont un peu plus grandes que celles du Goujon d'Europe; elles ont la surface couverte de stries un peu divergentes, trés-fines et serrées; on compte 42 à 44 écailles sur la ligne latérale et 11 rangées d'écailles entre le dos et le ventre, dont 5 se trouvent au dessus de la ligne latérale. La ligne latérale est presque droite, et ne monte que par devant très-insensiblement vers le haut. L'anus s'ouvre beaucoup plus vers le devant que dans le Goujon commun; se trouvant placé à la fin du premier sixième de la longueur comprise entre la fin de la base des ventrales et le commencement de l'anale, cet orifice est tout à fait rapproché de la ventrales.

Le nageoires de ce poisson offrent les particularités suivantes: Les pectorales se trouvent placées sur la ligne de la bouche; elles sont par conséquent tout à fait reculées vers le bas; dirigées vers le devant

elles se meuvent à peu près dans la direction de l'aex longitudinal du corps; leur longueur égale la distance comprise entre l'angle du préopercule et l'extremité du museau; elles s'étendent en arrière jusque sur la base des ventrales; elles sont arrondies vers le bas, et prolongées vers le derrière en uen pointe conique, dont l'extrémité est formée par le troisième rayon; les quatre premiers rayons sont un peu courbés; le premier est simple, les trois autres sont divisés en deux branches seulement, mais les suivants sont branchus comme d'ordinaire. Les ventrales sont d'un quart moins longues que les pectorales; leur extrémité est éloignée du commencement de l'anale à une distance égale aux deux tiers de leur longueur. L'anale est un peu plus courte que les ventrales, et très-faiblement échancrée à son bord inférieur; son dernier rayon est de moitié pHs court que le premier rayon mou: des trois rayons antérieurs indivisés, le premier est à peine sensible, et le dernier est gréle et flexible; aucun de ces rayons n'offre des dentelures. La caudale est moins échancrée que dans le Goujon commun, de sorte que la longueur de ses lobes libres n'occupe que deux cinquièmes de la longueur totale de cette nageoire. La dorsale nait vis-à-vis de la fin du deuxième tiers de la distance comprise entre la base des pectorales et des ventrales, son bord supérieur est droit et descend obliquement vers le bas, vu que le dernier rayon mou de cette nageoire est presque de moitié plus court que le premier; les trois rayons indivisés qui la précèdent sont semblables par leur construction, leur forme et leur longueur relative aux rayons correspondants de l'anale. D. 3+7, dont le dernier est, comme à l'ordinaire, double; A. 3+6, dont le dernier est également double; V. 1+7, dont le dernier est simple; P. 1+15; C. 19, outre les rayons latéraux accessoires.

Conservé dans l'esprit de vin, ce poisson offre une jolie teinte argentée, passant au brun sur le dos, qui est orné de cinq bandes assez larges d'un brun foncé; ces bandes cependant, orginairement formées par l'assemblage de petits points bruns, sont souvent en partie effacées, notamment sur le dessus du dos, de sorte qu'il n'en reste qu'une rangée de larges taches orbiculaires dipsoées le long de la ligne latérale, mais dont la couleur tire souvent sur le bleuâtre, notamment dans les jeunes individus. On voit sur l'opercule une tache semblable mais mal déterminée. Le dessus et les côtés de la tête sont ornés de petites taches brunes, le plus souvent de forme orbiculaire. La dorsale et la caudale sont pointillées debrun sur un fond jaunâtre. Les autres nageoires sont d'un jaunâtre uniforme, mais on voit souvent du brun le long des rayons de la face postérieure des pectorales.

Les dents pharyngiennes de cette espèce sont distribuées sur une selue rangée, très-serrées les unes contre les autres, grêles et pointues; on en compte cinq de chaque côtê.

Description: Head $3^3/_5$; depth 6; D. III, 7; A. II, 6; P. 16; V. 8, C. 5, 17, 5; scales 42 in lateral line; 5 scales in an oblique series between origin of dorsal and lateral line, and 5 scales between latter and middle of belly; pharyngeal teeth 6 or 5, 2–2, 5 or 6; width of head 2 in its length; snout 2 in head; eye 5; interorbital space $4^1/_4$; pectoral $1^2/_5$; ventral $1^2/_3$.

Body elongate, rather slender, tapering behind, and somewhat compressed; caudal peduncle much more compressed. Head large, elongate, pointed, and compressed; snout long, compressed, concave, and produced beyond mandible, tip bluntly rounded; eye rather small, $2^3/_5$ in snout, high, and nearer posterior edge of opercle than tip of snout; mouth small, inferior, protractile downwards, maxillary not reaching posteriorly as far as nostils; lips very broad and bleshy, and covered with well-developed papillae; a rather long thick maxillary barbel equal to two-thirds eye; pharyngeal teeth simple, small, slender, compressed, hooked, and those in lesser row very small and feeble; nostrils together and nearer eye by two-thirds length of snout; interorbital space broad and concave, and top of head also concave. Gill-openings large and membranes broadly united to isthmus, forming a rather fleshy flap on each side below; gill-rakers on first gill arch developed as fleshy dactyloid excresces 3 + 15; gill-filaments long and very numerous.

Intestine with a single convolution. Anus opened far anteriorly, nearly just beihnd base of ventral fin insertion. Peritoneum silvery. Lateral line continuous, slightly decurved anteriorly, running through almost middle of body with loose undulations. Scales large and cycloid, none on breast; no pectoral flap; ventral flap present.

The dorsal inserted nearer tip of snout than base of caudal by diameter of eye, third unbranched ray longest, dorsal margin slightly emarginate; anterior developed dorsal rays extending beyond tips of last when fin is depressed, and upper edge of fin straight or emarginate; pectoral low down, with slightly emarginate posterior margin; origin of anal about midway between tip of depressed dorsal and base of caudal; caudal deeply emarginate and lobes pointed; pectoral broad, rounded, and reaching beyond origin of dorsal, and almost to origin of ventral; origin of ventral well behind origin of dorsal, and when depressed extending for half space to origin of anal. Caudal peduncle rather short and compressed, its least depth about 4 in head. Lateral line nearly straight and continuous to base of caudal.

Table 55. Measurement of *Pseudogobio esocinus* (TEMMINCK et SCHLEGEL).

Collection	Fish. Mie Univ.*			O. H. B. S.**	
Total length	171.0mm.	138.0mm.	129.0mm.	157.0mm.	82.0mm.
Body length	145.0	113.0	104.0	135.0	67.0
Body length/Head	3.04	3.39	3.32	3.64	3.52
Body length/Depth	5.57	5.62	5.10	6.13	4.18
Body length/Predorsal length	2.14	2.18	2.14	2.18	2.16
Body length/Prepectoral length	3.13	3.24	3.58	3.74	3.52
Body length/Preventral length	1.83	1.92	1.98	2.08	1.81
Body length/Preanal length	1.22	1.22	1.22	1.53	1.31
Head/Snout	2.09	2.09	2.16	2.06	2.15
Head/Upper jaw	3.14	3.04	2.93		
Head/Interorbital width	3.79	4.30	4.05	4.11	3.80
Head/Diameter of Eye	5.02	4.93	5.23	4.62	4.75
Head/Length of Caudal peduncle	2.39	2.64	2.90	1.94	1.19
Head/Depth of Caudal peduncle	4.07	3.85	3.70	3.70	2.72
Head/Length of Dorsal fin	2.70	2.52	2.53	1.94	1.73
Head/Length of Anal fin	5.00	4.65	4.50	3.11	3.80
Head/Height of Dorsal fin	1.52	1.41	1.38	1.42	1.46
Head/Height of Anal fin	2.20	2.16	1.96	2.35	2.16
Head/Pectoral length	1.38	1.39	1.33	1.42	1.46
Head/Ventral length	1.73	1.78	1.65	2.46	1.90
Date	VIII, 1955		IX, 1955	1958	
Locality	River Machiya, River Kumozu, Mie Prefecture			Lake Biwa, Shiga Prefecture	

*Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.
**Ôtsu Hydrobiological Station attached to Kyôto University.

Color in formalin reddish brown, lighter below; upper parts with dark spots; about ten brown spots along lateral line; an oblong spot on side of body, directly behind opercle and above pectoral; dorsal and caudal dusky, with several bands of brown spots; pectoral dusky and spotted on its inner surface, but pale and plain on its outer; ventral dusky on upper surface, but pale on the lower; anal pale, without markings.

Type locality: Near Nagasaki.

Secondary sexual character: Pearl organs appear on the snout, upper and lower jaws, around the orbit, preopercle, postoccipital, pectoral fin and back of the male.

Habits: The fish mature in 3 years after hatching. The number of eggs ranges from 10,000 to 20,000 in adult. The breeding season occurs at the end of March and in the middle of April, around Tôkyô. In Lake Biwa, the female deposits eggs on the sandy bottom along the coast. This fish is a typical bottom feeder, taking food from the sandy bottom of clear rivers and sometimes conceals himself in the sand. In winter it goes down into the deep of the river to winter.

Distribution: Lake Biwa (SAUVAGE): Yechigo; River Tama; Chichibu; Suwa; Shinshû; Owari; Lake Biwa Matsubara; River Katsura; Yamashiro; Kyôto; Kurume, Kyushû (ISHIKAWA); Lake Biwa, (JORDAN & SNYDER); Lake Biwa, Matubara; River Kitakami, Morioka; Matusima; River Kinu, Utsunomiya; River Chikugo, Kurume; Tsuruga, Echizen; River Yodo, Ôsaka; Kawatana Hizen; River Iwai, Ichinoseki; River Kaminutani, Ômi; Karasaki, Lake Biwa (OTAKI); Lake Biwa; River Kati, Nagoya (JORDAN); Kumamoto (WAKIYA); Lake Suwa (JORDAN); Nagoya (NAKANO); Himezi (ABE); Okayama (MIKAMO); River Chikuma (OTA); River at Yamada (TSUCHIGA); River Kino; River Arita, Wakayama Prefecture (UI); Kyôto-fuka (MIYADI); River Kiso; Kiso Valley; Uematsu; Suhara; Nojiri; River Hida (NIWA); Matsubara, Lake Biwa (ISHIKAWA); River Kitakami (AOYAGI); River Kôzu, Shimane Prefecture (TANAKA); RiverYoshino (TANAKA, KASAI, KAMOHARA); Nagasaki; River Sendai, Kagoshima (OGAWA); River Gokase, Miyazaki (AOYAGI).

Remarks: The present species is distributed in Japan except with Hokkaidô and Aomori Prefecture. They are demersal fish dwelling on the sandy bottom of river sand lakes and sometimes burried into the sand. Spawning season occurred during the end of spring and the beginning of summer. They are depositing eggs of 10–20 thousands on pebble and sandy bottom of the shallow water of lakes and calm water of rivers.

NIWA* mentioned the situation of anus opened far anteriorly than in other species. He has also pointed out that the situation of opening of anus is as nearly as in *Liobagrus reini* HILGENDORF, and rather anteriorly.

Genus Hemibarbus BLEEKER, 1861.

Hemibarbus BLEEKER, 1861, Prodr. Cyprin., p. 281.
Type: **Hemibarbus barbus.**

Characters: Body elongate, rather slender, and compressed. Head elongate, somewhat pointed, and with many mucous cavities about the eyes and along the edge of the preoperculum; snout long; blunt at the tip; eye rather large, high; mouth inferior, the maxillary not reaching eye; lips fleshy; each maxillary with a barbel as long as the eye; teeth 5, 3, 1–1, 3, 5. Gill-rakers short; intestine short. Peritoneum silvery; scales cycloid,

*NIWA, 1954, Fishes of Kiso Valley, pp. 115–116.

about 49. Dorsal fin inserted nearer the tip of the snout than the base of the caudal and armed with a slender, sharp, strong, smooth spine; anal inserted far behind the tip of the depressed dorsal fin; caudal deeply emarginate, the lobes pointed; ventrals inserted behind origin of the dorsal. Lateral line slightly decurved and continuous. Widely distributed in Japan, Korea, Manchuria and China.

Key to Japanese Species of Hemibarbus

a[1] Dorsal spine hard on the end, the posterior margin of lower jaw with broad membrane. ....**H. barbus**

a[2] Dorsal spine soft on the end, the posterior margin of lower jaw without membrane. ....**H. longirostris**

56. Hemibarbus barbus (TEMMINCK et SCHLEGEL).
Skincarp, "Nigoi, Sai"
(PL. XXVIII, figs. 1–4)

Gobio barbus TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poiss., p. 198, Pl. xcix, fig. 1.

Hemibarbus barbus BLEEKER, 1861, Prodr. Cyprs., p. 281. – JORDAN et SNYDER, 1901, Check List of Fish. Japan, p. 46. – JORDAN et EVERMANN, 1902, Proc. U. S. Nat. Mus., p. 322. – JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., Vol. 26, No. 1334, pp. 824-825. – TANAKA, 1909, Annot. Zool. Jap., p. 131. – TANAKA 1913, Cat. Fishes Japan, p. 66. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. 6, p. 214. – TANAKA, 1921, Nihon Gyogaku, pp. 185-186. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, p. 172. - MIYADI, 1953, Kyôtofuka Tansuigyo, p. 26–27, pl. 4, fig. 28. - OKADA, MATSUBARA et UCHIDA, 1935, Nihon Gyorui Zusetsu, pl. 29, fig. 2. -MIYADI, 1935, Shinsyu no Gyorui, pp. 219-220, figs. 119-120. – OKADA et IKEDA, 1938, Saito Ho-on Kai Mus. Research Bull. no. 15, pp. 91-92, text-fig. 3. – OKADA & MATSUBARA, 1938, Keys Fish & Fish-like Anim. Japan, p. 73. – OKADA & NAKAMURA, 1948, Nihon Tansuigyorui, pp. 158–159, fig. 79. – KAMOHARA, 1950, Desc. Fish. Prov. Tosa & Kishû, p. 46, fig. 41.

Barbus schlegeli GUNTHER, 1868, Cat. Fish., vii, p. 135. – ISHIKAWA, 1897, Prel. Cat., p. 15.

The original description* is as follows:

Gobio barbus
Pl. XCIX, fig. 1.

La deuxieme espèce de Goujon des eaux donces du japon est très differente non seulement de celle que nous venons de decrire, mais encore de toutes celles connues jusqu'à present. Ce poisson curieux rappelle le barbeau commun par sa forte taille, et en général aussi par ses formes et sa physionomie; l'orifice de son anus, au lieu d'être avancé comme dans les Goujons s'ouvre tout près du commencement de l'anale; sa bouche n'est garnie de chaque côte que d'un seul tentacule pendant de la partie postérieure du maxillaire, absolument comme cela a lieu dans les Goujons; ses lèvres ne sont pas frangées comme dans le Goujon ésocin et le barbeau commun, mais à bord simple comme dans le Goujon commun; sa poitrine est recouverte d'ecailles; le troisième rayon de la dorsale, au lieu d'être faible comme dans les Goujons, est très-robuste comme dans les Barbeaux, quoique nullement dentelé à son bord posterieur; ses sous-orbitaires enfin sont, comme dans certains Percoides, tels que les Acé-

*TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poisson, p. 198.

rines, revêtus d'une couche adipeuse, ce que l'on n'observe ni dans les Goujons ni dans les Barbeaux.

Cette espèce nous est connue par trois individus, dont l'un est empaillé et de dix-sept pouces de long,. tandis que des deux autres qui sont consérves dans l'esprit de vin, l'un offre en longueur près de neuf pouces, l'autre quatre pouces et demi. Le dessin que nous publions de cette espece a été fait sur le frais, d'après le plus grand de nos individus conservé dans la liqueur forte.

La grosseur du corps vis-à-vis du commencement de la dorsale est deux fois et un sixième dans la hauteur du corps au même endroit, et cette hauteur est environ cinq fois dans la longueur comprise entre le bout du museau et l'echancrure de la caudale. La tête entre quatre fois et demie dans cette longueur, et le museau est deux fois et demie dans la tête. L'entre-deux des yeux egale le diamètre des orbites qui est une fois et demi dans la longueur du museau.

Les yeux ne sont pas tout à fait places a fleur de tête. Le milieu du front est légèrement concave et bordé de chaque côte d'une ligne saillante, qui se prolonge jusque sur le milieu du museau; les côtes du front sont un peu inclinès vers le bord des orbites. La ligne de demarcation entre la tête et la nuque est arquée, mais elle forme au milieu un angle saillant. Le museau, vu de côte, est peu conique; sa moitie antérieure est arrondie, et passablement grosse. Les narines se trouvent placées, vers le haut, à une distance de l'aeil égale a la moitié du diamètre de ces organes. On voit, sur le museau, entre son extrémité et les narines, une saillie conique, probablement formée par la pointe antérieure et supérieure des palatins. La fente de la bouche se prolonge sur le dessous du museau jusqu'à son extrémité; elle est étroite, et le maxillaire ne s'étend en arrière que jusque sous l'aplomb du commencement de la deuxième moitié du museau. Le barbillon qui pend de sa partie postérieure est grèle et sa longueur égale à peine deux tiers du diamètre de l'orbite. La mâchoire inférièure est un peu plus courte que la supérieure, et toutes les deux sont garnies de lèvres charnues mais simples et nullement frangées. Le premier sous-orbitaïre est assez grand; mais il est revetu a sa moitié inférieure d'une substance adipeuse, qui se prolonge au dessous et derriére l'aeil jusqu'aux côtes de l'occiput, et qui cache dans son épaisseur une rangée de lames osseuses très-minces mais passablement larges et semblables à des écailles. Une substance adipeuse analogue à celle dont nous venons de faire mention se prolonge le long des bords du préopercule. Toutes les parties de la tête sont revêtues d'une peau lisse, et l'opercule même, où ces teguments sont extrêmement minces, offre une surface presque tout à fait unie. Les écailles ont leur surface marquée de stries serrées, mais très-délicates et très-peu divergentes; on compte environ 48 écailles sur la ligne latérale, et entre le dos et le ventre 16 rangées d'écailles, 8 au dessus de la ligne latérale. Cette ligne est droite, mais par devant elle se courde comme d'ordinaire un peu vers le haut. L'anus s'ouvre immédiatement au devant do commencement de l'anale.

La longueur des pectorales égale environ celle de la tête sans le museau; couchees en arrière, leur pointe est éloignée de la base des ventrales à une distance égale à la moitié de leur longueur. Les ventrales sont presque d'un quart plus courtes que les pectorales, et eloignees avec leur extrémité de la base de l'anale à une distance presque égale à leur leur longueur totale. L'anale tient par rapport à sa longueur le milieu entre les ventrales et les pectorales; les trois rayons indivisés, qui précédent les rayons mous, sont grêles, nullement denteles, et le troisième est même très-flexible à sa moitie terminale; le bord inférieur de cette nageoire est coupé carrément. La caudale est profondément échancrée. La dorsale nait sur la ligne verticale imaginaire qui indique la fin du troisième quart de la distance comprise entre les pectorales et les ventrales; sa hauteur par devant surpasse d'un quart la longueur des pectorales, mais par derrière elle est plus de moitié plus basse que par devant; son bord supérieur est droit; sa première epine est extrêmement petite, la troisième est très-longue et très-vigoureuse, mais aucune de ces épines n'est dentelee. D. 3+7; A. 3+6; V. 1+8; P. 16; C. 19, outre les rayons lateraux accessoires.

Le fond de la teinte dans les individus vivants est un vert grisâtre très-pâle, tirant au brun sur le dos et a l'argenté sur les parties inférieures. La tête est nuancée d'un roux clair mais assez vif. Les écailles, à l'exception de celles des parties inférieures, sont marquées à la base de leur partie libre d'une raie verticale d'un brun couleur de foie; et l'on voit dur le corps des raies longitudinales d'un brun très-clair, dont le nombre correspond à celui des rangées d'ecailles, mais qui sont très-peu sensibles et qui s'effacent complètement sur le dessous du poisson. Les nageoires sont d'un bleu grisâtre,

tirant un peu au roux sur les rayons des nageoires inférieures. L'iris est d'un blanc argenté et l'on observe des teintes roses autour de la bouche.

Je ne trouve à cette espèce que quatre dents pharyngiennes, serrées et très-pointues comme dans la précédente.

Description: Head $3^3/_4$; depth $4\,^1/_2$; D. III, 7; A. III, 6; p. 20; V. 9; scales 49 in the lateral line; 7 scales in oblique series between the origin of dorsal fin and lateral line, and 7 scales between latter and middle of belly; pharyngeal teeth 5, 3, 1–1, 3, 5, width of head $2\,^1/_4$ in its length; snout $2\,^3/_4$ in head; eye 5; interorbital space $3\,^3/_4$; pectoral fin $1\,^1/_2$; ventral fin $1\,^7/_8$; eye 2 in snout.

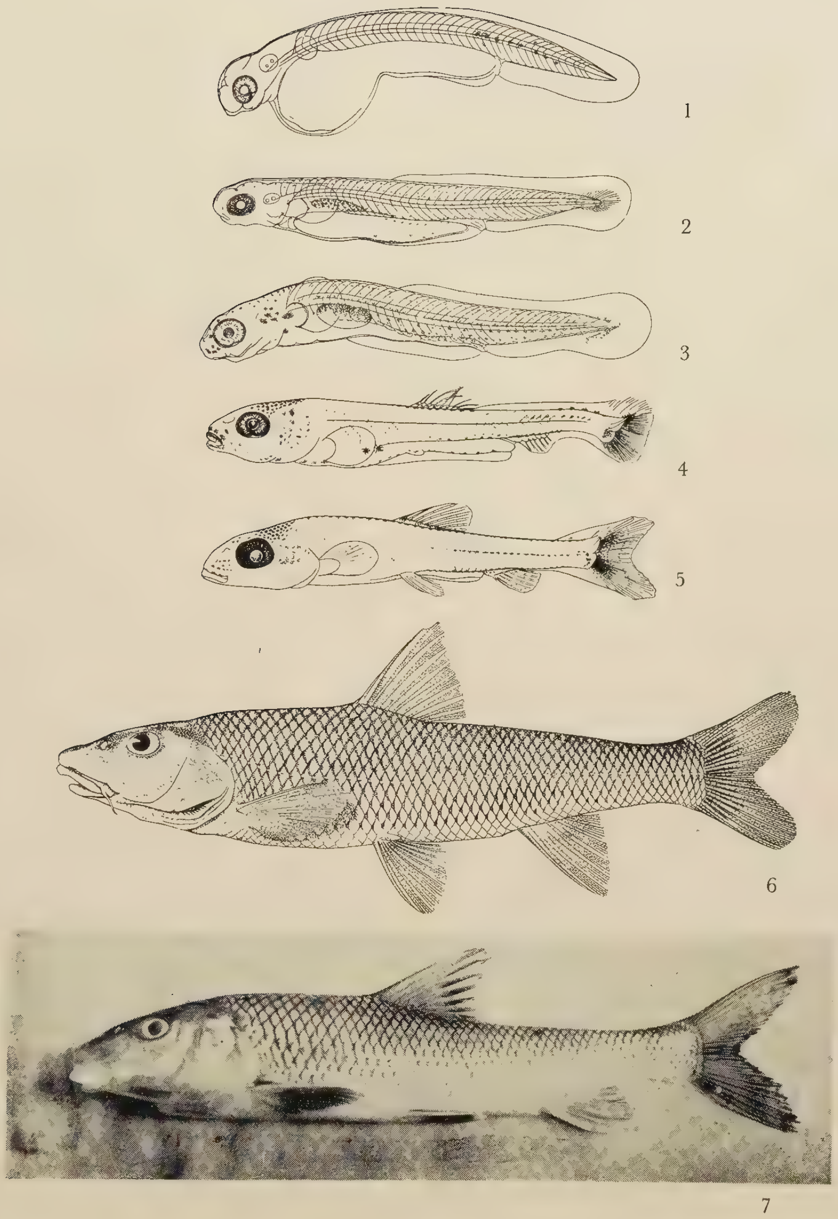
Body elongated and compressed, pointed, greatly depressed, with many mucous cavities around eyes and below and behind edge of preoperculum; snout long, pointed, and produced; eyes moderately large, anterior and superior; mouth small, inferior, and with upper jaw produced; lips fleshy and not broad; a slender maxillary barbel equal to diamenter of eye; pharyngeal teeth in 3 rows, several compressed and with grinding surfaces, and compressed, those in inner row small; nostrils together in front of eye and about over base of maxillary barbels so that they are much nearer eye than tip of snout; interorbital space and tip of head broad and flattened. Gill-openings large; gill-rakers 7–12, some of lower ones rudimentary; those which are well-developed short and fleshy. Intestine short. Peritoneum silvery. Scales large, cycloid, of more or less uniform size, and no scaly pectoral flap; ventral flap moderate. Dorsal fin inserted nearer tip of snout than base of caudal fin armed with a long, straight, smooth spine, anterior dorsal rays longest, so that when the fin is depressed the first reaches beyond the others; anal fin entirely behind dorsal and midway between origin of ventral fins and base of caudal; caudal fin deeply forked, lobes pointed; pectoral fins reach threefourths distance to ventrls; origin of ventral fins behind that of dorsal, about midway between tip of snout and base of caudal, and reaching a little more than half space to anal; caudal peduncle compressed, its least depth a little over 3 in head. Lateral line continuous and slightly decurved in front.

Table 56. Measurements of *Hemibarbus barbus* (TEMMINCK et SCHLEGEL).

Collection	Fish. Mie Univ.*	Collection	Fish Mie Univ*
Total length	197. 0mm.	Head/Interorbital width mm.	3. 68mm.
Body length	162. 0	Head/Diameter of Eye	4. 40
Body length/Head	3. 50	Head/Length of Caudal peduncle	1. 63
Body length/Depth	4. 85	Head/Depth of Caudal peduncle	3. 19
Body length/Predorsal length	2. 12	Head/Length of Dorsal fin	2. 50
Body length/Prepectoral length	3. 60	Head/Length of Anal fin	3. 70
Body length/Preventral length	1. 95	Head/Height of Dorsal fin	1. 65
Body length/Preanal length	1. 33	Head/Height of Anal fin	2. 05
Head/Snout	2. 89	Head/Pectoral length	1. 62
Head/Upper jaw	4. 21	Head/Ventral length	1. 95
Date	VIII, 1955		
Locality	Lake Biwa, Shiga Prefecture		

* Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

PLATE XXVIII



Development of ***Hemibarbus longirostris*** (REGAN), after K. UCHIDA.

1. Larva just hatching out, 5.6 mm. total length.
2. Larva 2 days after hatching out, 7.8 mm. total length.
3. Larva 5 days after hatching out, 7.5 mm. total length.
4. Juvenile, 11.0 mm. total length.
5. Juvenile, 15.0 mm. total length.
6. ***Hemibarbus barbus*** (TEMMINCK et SCHLEGEL), Lake Biwa. ♂
7. ***Hemibarbus barbus*** (TEMMINCK et SCHLEGEL), Lake Biwa. ♂

Color in alchohol brassy-brown above, sides and lower surface silvery. Color in fresh, body silvery white and dark greyish along dorsal side, gradually lighter near ventral side. Ventral side white, head and anterior body light yellowish brown. Dorsal fin light yellowish; pectoral, ventral and anal fins* greyish black and the caudal fin with light yellow scales margined with black.

Remarks:– The author pointed out that two types of patterns on the body are found in the specimens from the Tôhoku district. One is provided with clear blotches along the sides of the body and the dorsal ridge, and the other with no such blotches.

The normal coloration at different localities has been well described by TANAKA** as follows. "Dark gray above, pale beneath; free edge of each scale black punctate. Several faint longitudinal streaks, consisting of blackish dots, run on upper parts of body. Two longitudinal rows of blackish spots, somewhat concurrent with contour of back; the lower row runs anteriorly just above the lateral line, but posteriorly right on that line; the spots of the row being smaller in size than the pupil. The upper row much fainter than the lower; its spots above the interspaces of those of the lower row. All the spots are more distinct in the smaller specimens. In small specimens, a black longitudinal line runs on the back from the beginning of nape to the caudal base; it forks into two at the insertion of dorsal, to surround this at the base; the line sometimes represented by row of blackish spots. Head brown above, pale beneath; dorsal and caudal brownish, the edges much darker; anal fin pale or brownish, the free edge being darker in some specimens than in others; ventral and pectoral fins pale.

Table 57. Measurements of *Hemibarbus barbus* (TEMMINCK et SCHLEGEL).

Specimen of Saitô Hô-on Kai Museum	Standard Length	Depth of body	Head	Snout	Eye	Interorbital space	Maxillae	Depth of Caudal Peduncle
		in S. L.	in S. L.	in H.	in H.	in H.	in H.	in H.
No. 5738	272 mm.	3.9	3.5	2.5	5.8	3.4	4.5	2.8
———	324 〃	4.0	3.7	2.4	6.3	3.4	4.5	2.8
No. 16795	335.3 〃	4.8	3.6	2.5	7.3	3.3	4.0	3.0

Number of gill rakers		Number of dorsal & anal fin rays		Number of Predorsal	Scales in L. L.	Scales above L. L.	Scales below L. L.
		D.	A.				
8	5	III, 71	II, 7	16	45	7	7
8	5	III, 71	II, 7	18	46	8	8
8	4	III, 71	II, 7	15	47	7	6

Habits: The present species live in large rivers of plain lakes and swamps, sometimes bound in brakish waters. The fish are the bottom feeders mostly found in the steady, somewhat deep bottom of a lower. Around Tôkyô, they breed in April and June. They select a pebbly bottom along the coast for spawning. The eggs are deposi-

* OKADA & IKEDA, 1938, Saitô Hô-on Kai Mus., Res. Bull. No. 15, p. 92.
** OSHIMA regarded the present species and *H. labeo* (PALLAS).

ted on weeds or pebbles. The number of deposited eggs are 5–10 millions. Eggs are reddish brown, strongly adhesive. The food is consisting of small crustaceans, worms, aquatic insects and organic matters of the bottom.

GUNTHER took *Hemibarbus barbus* described the name only by BLEEKER in his Prodr. Cypri. p. 281, under the synonym of *Barbus schlegelii* mentioned in page 198 of Fauna Japonica, Poiss. on.

Type locality: near Nagasaki.

Distribution: Nagahama; Osaka; Tôkyô; Yokohama (JORDAN & SNYDER); Formosa (JORDAN & EVERMANN); River, Yodo ÔSaka (JORDAN & FOWLER); Zinsaburogata, Nishitsugaru, Aomori (SAITO); River, Chikugo Kurume; Tôkyô (Albatross Exp.); Matubara, Lake Biwa (JORDAN & THOMPSON); Ôsaka and Tôkyô markets (JORDAN); Lake Suwa (JORDAN); Nagano (NAKANO); River, Hino Fukui; Lake Kasumigaura (HATTORI); Aomori to Formosa (TANAKA, JORDAN & SNYDER); Japan except Hokkaidô (OKADA & NAKAMURA); Aomori Pref.; Akita Pref.; Yamagata Pref.; Miyagi Pref; Fukushima Pref. (OKADA & IKEDA); Hashimoto; Gozyô, Nara Pref.; River, Yoshino Nara Pref.; Iwaide (KAMOHARA); Kyoto (MIYAGI); Aomori Prefecture; Iwate Prefecture (AOYAGI); River, Ashiba Fukui Prefecture (KATO); River Kitakami (KITAHARA); Lake; Biwa River Yodo (TANAKA); River Kako (NAKAGAWA); River, Yoshino Kôchi Prefecture (TANAKA, KASAI); River, Chikugo Kumamoto Prefecture (AOYAGI).

57. Hemibarbus longirostris (REGAN).

"Zunaganigoi"

(Text-fig. 78)

Acanthogobio longirostris REGAN

Hemibarbus longirostris CHU, 1931, Biol. Bull. St. Johns Univ., No. 1, p. 56. – UCHIDA, 1939, Bull. Fish. Exp. Stat. Tyosen, No. 6, pp. 182–191, pl. 16, figs. 1–7; Pl. 19, figs. 1–5. – OKADA & NAKAMURA 1948, Nihon Tansui Gyorui, p. 159, Fig. 80.



Text-fig. 78. ***Hemibarbus longirostris*** (REGAN). Ueno, Mie Prefecture.

Description: Body somewhat depressed, elongated. Head pointed with long snout. Mouth below, snout slightly projected beyond the mouth. Nostrils close together, open-

Table 58. Measurements of *Hemibarbus longirostris* (REGAN).*

Sp. No.	Date	Locality	Sex	T. L.	D. F.	A. F.	S.	B.L./B.H.
				mm.	mm.	mm.		
No. 1	I × 17 22. 1934	Mitsuyo-Ko	?	101.0	111.7	111.5	$41^{5.5}/_{5}$	4.5
No. 2	V 25 29. 1934	——	♂	115.0	111.7	111.5	$41^{5.5}/_{5}$	4.8
No. 3	——	——	♀	121.0	111.7	111.5	$41^{5.5}/_{5}$	4.7
No. 4	V 30, 1935	Juoyo	♀	123.0	111.7	111.5	$42^{5.5}/_{5}$	4.3
No. 5	——	——	♀	128.0	111.7	111.5	$42^{5.5}/_{5}$	4.8
No. 6	——	——	♀	129.0	111.7	111.5	$42^{5.5}/_{5}$	4.2
No. 7	V 5, 1935	Shuryosen (Tansuko)	♀	141.0	111.7	111.5	$41^{5.5}/_{5}$	4.6
No. 8	I × 17 22. 1934	Mitsuyo-Ko	♀	143.0	111.7	111.5	$41^{5.5}/_{5}$	4.6
No. 9	——	——	♀	152.0	111.7	111.5	$42^{5.5}/_{5}$	4.9
No. 10	V 30, 1935	Junyo	?	186.0	111.7	111.5	$42^{5.5}/_{5}$	4.5
No. 11	I × 30, 1933	Ungen (Tanzuko)	♂	82.0	111.7	111.5	$42^{5.5}/_{5}$	5.3
No. 12	VII 18, 1935	Mitsuyo-Ko	?	95.0	111.7	111.5		4.7
No. 13	I × 25, 1936	Hėizyo	♀	212.0	111.7	111.5	$43^{5.5}/_{5}$	4.8
No. 14	——	——	♀	222.0	111.7	111.5	$42^{5.5}/_{5}$	4.8

Sp. No.	B.L./H.L.	H.L./S.L.	H.L./E.D.	H.L./I.S.	H.L./P.L.	H.L./V.L.	H.L./A.H.	H.L./C.H.	G.R./S.	V. N.
No. 1	3.4	2.1	4.0	4.0	1.6	1.7	1.5	3.4	2+4=6	
No. 2	3.3	2.1	4.0	4.0	1.5	1.8	1.8	3.5	3+4=7	
No. 3	3.3	2.2	4.8	4.0	1.5	1.7	1.4	3.5	2+4=6	
No. 4	3.4	2.1	4.3	4.1	1.6	1.8	1.5	3.4	3+4=7	
No. 5	3.5	2.1	4.2	4.0	1.6	1.8	1.6	4.0	2+4=6	
No. 6	3.5	2.0	4.2	3.7	1.5	1.7	1.5	3.3	2+4=6	36
No. 7	3.6	1.9	4.1	3.7	1.5	1.7	1.3	3.4	3+4=7	35
No. 8	3.4	2.1	4.3	3.6	1.5	1.6	1.3	3.0	2+5=7	35
No. 9	3.3	2.2	4.3	3.8	1.6	2.0	1.5	3.7	3+4=7	
No. 10	3.6	2.2	3.6	3.3	1.4	1.7	1.8	3.0	3+4=7	35
No. 11	3.2	2.0	4.1	4.0	1.6	1.8	1.5	3.6	3+5=8	
No. 12	3.3	2.0	4.2	2.8	1.6	1.8	1.6	3.5	3+4=7	
No. 13	3.5	2.1	4.4	3.5	1.5	1.7	1.1	3.5	3+4=7	35
No. 14	3.5	4.0	4.0	3.4	1.5	1.6	1.1	3.4	3+4=7	35

* These measurements were made by UCHIDA for the specimens collected in Korea.

ed nearer the anterior margin of the orbit than tip of snout. Eye situated near the back; interorbital space flat on surface; mandible horse-shoe shaped, the upper lip somewhat thick; maxillae close to inner side of mandible; lower lip somewhat thick, without membrane. Short barbels, about $^1/_2$ of eye diameter long, on the posterior corner of the mouth, reaching somewhat beyond the posterior nostrils but not to the orbit. Gill openings broad; gill rakers big and short. Pharyngeal teeth 3 rows, 5, 3, 1–1, 3, 5 usually; number of teeth changeable. Intestine short, peritoneum light colored. Scales large, cycloid; year ring undistinct.

The dorsal fin nearly triangular in form, inserted midway between snout and base of caudal fin; the first spine very short and emargined under skin; the second spine slender, reaching middle of anterior margin of dorsal fin; the third reaching nearly the tip of fin, flap-like, soft and segmented at end, ossified and hard on the distal. Anal fin inserted from somewhat posteriorly by from the end of dorsal fin which bring down posteriorly; short and high; the posterior fin ray short; height of anal different in sexes; in male lower than in female. Caudal fin deeply forked, the ends of both lobes somewhat bluntly pointed. The end of pectoral fin reaching to $^2/_3$ of eye diameter from in-

Table 59. Measurement of the body of females showing secondary sexual characters.*

Total length	T.L./C.L.	A.L./C.L.	P.L./C.L.	T.L./H.L.	H.L./A.L.	H.L./P.H.	ovary
99	8.2	1.1	1.3	4.3	1.6	1.5	unripe
101	7.7	1.0	1.1	4.0	1.7	1.6	——
106	8.1	1.1	1.2	4.0	1.6	1.6	ripe
108	7.7	1.1	1.1	4.1	1.6	1.6	unripe
108	7.7	1.0	1.1	4.3	1.6	1.6	——
108	8.3	1.3	1.2	4.1	1.5	1.6	——
109	7.7	1.2	1.2	4.1	1.4	1.5	——
109	6.8	1.0	1.0	4.0	1.6	1.5	——
112	7.0	1.0	1.0	4.1	1.6	1.6	——
112	8.0	1.2	1.1	4.3	1.7	1.6	——
112	8.0	1.2	1.0	4.0	1.5	1.8	——
113	8.0	1.2	1.2	4.1	1.5	1.5	——
114	8.1	1.2	1.2	4.2	1.5	1.5	——
114	8.1	1.2	1.1	4.2	1.5	1.6	——
116	8.2	1.4	1.2	4.1	1.4	1.5	——
120	8.0	1.3	1.1	4.0	1.5	1.7	ripe
122	8.1	1.2	1.0	4.2	1.4	1.7	——
123	7.6	1.3	1.2	3.9	1.4	1.5	——
127	7.9	1.2	1.1	4.2	1.5	1.6	——
129	8.0	1.4	1.1	4.3	1.4	1.6	——
132	8.2	1.3	1.1	4.2	1.4	1.6	——
133	8.3	1.4	1.1	4.1	1.4	1.6	——
138	8.1	1.4	1.2	4.4	1.2	1.5	——
140	8.2	1.5	1.1	4.1	1.3	1.7	——
154	8.1	1.3	1.1	4.2	1.3	1.6	——
177	8.8	1.6	1.3	3.9	1.3	1.7	——

Abbreviations: T.L.=Total length; D.F.=Dorsal fin; A.F.=Anal fin; S.=Scale; B.L.=Body length; B.H.=Body height; H.L.=Head length; S.L.=Snout length; E.D.=Eye diameter; I.S.=Interorbital space; P.L.=Pectoral length; V.L.=Ventral length; A.H.=Anal length; C.L.=Caudal length; G.R.=Gill rakers; V.N.=Vertebrae number.

*River Yalu (GINSBURG, 1917); River Yalu (MORI, 1927).

sertion of ventral fin. The ventral fin inserted somewhat posteriorly from the middle of the insertions of ventral and anal fins. Scale like appendages on the base of ventral fins but not on the pectoral fins. Caudal peduncle somewhat depressed and not high. Lateral line somewhat curved on anterior half, and straight down on the middle of body to the end of caudal deduncle.

Coloration: In fresh, body silvery, somewhat dark brown on the back; 7 to 9 black, eye-lid sized patterns lined longitudinally along dorsal of lateral line in some intervals. The longitudinal eight lines of black spots run on the latero-dorsal sides excepting with ventral side. These black spots occur on the tip of each scale. In the young, these black spotted lines are distributed somewhat irregularly. Black spots on dorsal and caudal fins; on dorsal fin these are arranged in lines parallel to posterior margin while on caudal fin they are arranged in lines parallel to posterior folked margin of caudal fin. The other fins colorless.

Secondary sexual characters: In the female, anal fin higher than in male; pectoral fin bright orange yellow in male and light yellow in female. The pearl organ occurs on entire surface of head, on anal, pectoral and ventral fins, and all scales of the male; the most distinct ones develop on lateral sides of anterior half of head, and on anal and ventral fins. Small pearl organs may occur on full grown female. The first appearance occurs in specimens measuring 100 mm. of body length.

Habits: The breeding habits is not yet studied in Japan. Generally the fish are bottom feeders and like to live in the clear, sandy bottom of upper rivers. In winter, they gather in the spring area of the river to winter. This is more often found in the upper region of a river than in the middle region of river with sandy-pebbles bottom. The food consists of small insects and their larvae, intermingled with *Diatomes* and sand gravels.

Life history: Spawning season occurs during May to June. UCHIDA described and observed the development of the species from the specimens collected at the upper stream of Northern Kankô, Korea.

Egg: The egg with diameters of 1.5–1.8 mm. the yolk light yellow.

Larval stage: The larva after hatching has a body length of 5.8 mm. and $26+13=39$ myotomes. The head is projected anteriorly from the anterior end of snout and provided with mouth slightly opened. Anus opens at $^1/_3$ of the posterior end of body. Yolk is light brown, round anteriorly and somewhat elongated reaching to the vent.

Pectoral fin is fan-shaped. Membranous fin slightly developed, inserted from the middle of the abdomen, extending to the anterior part of the anus along the ventral side. Eye-cup light black. Grayish chromatophores are scattered on the lateral sides of the posterior half of the body. Larva, two days after hatching measures 7.2 mm. in body length, and has 40 myotomes. Yolk sac remained along the base of pectorals to the front of the anus. Mouth opens on the lower side of the snout. Pectoral fin fan-shaped and large. Air bladder appears at the posterior part of the base of pectoral fin. Body

light brown, with small black and brown chromatophores on the surface, except in the areas of the throat and the anterior part of the yolk sac.

Many black chromatophores gathered densely near the air bladder. Larva, 5 days after hatching, measures 7.5 mm. in body length, and has 40 myotomes. Yolk sac is absorbed. Anlage of the barbel appears at the angle of the jaws. The lower jaw short, hidden in the upper jaw. Black chromatophores appear on the lateral sides of the snout and on the caudal peduncle. Eye is black in the fresh. Larva with a body length of 11. mm. has 42 myotomes, and elongated body. Snout somewhat projected; mouth opens on the lower side of the anterior part of the snout. Eye is elliptical, situated somewhat near the dorsal side of head. The anlage of the ventral fin appears on the anterior part of the base of the dorsal fin. The fin rays of the dorsal and caudal fins slightly developed while those of anal fin are very weak. Pectorals are still membranous. Black chromatophores appear on the head region (tip of the head, snout, jaws, chin, opercle) and on the dorsal side (the base of dorsal fin, caudal peduncle), and on the ventral side (along the ventral side of alimentary canal and the entire lower margin of lateral muscle layer). They are also exhibited on the dorsal side of swim-bladder and on both the upper and lower sides of vertebrae. Larva with a body length of 15 mm. has somewhat higher breadth in the anterior part of the body. The ventral and pectoral fins are completely formed and the membranous fin remains a little at the base of the caudal fin. The upper jaw projected anteriorly somewhat more than the lower jaw. The barbels appear at the angle of both jaws. Fins well-developed, larger than those of the adult, especially the dorsal and caudal fins. Caudal fin is deeply bifurcated. Black chromatophores appear in 4 groups arranged in equidistant from each other on the upper shoulder, the proximal and distal bases of dorsal fin and on the caudal peduncle. Small black pigments appear along the lateral line from the posterior base of the dorsal fin to the caudal peduncle. Larva with a body length 18 mm. has newly developed scales on the latero-dorsal part, and the lateral line with black pigments. Mouth opens on the lower side of the snout. All the fins well developed, larger than the adult. Juvenile of 35 mm. body length have barbels on the angle of the jaws. The outer features are nearly the same as the adult; provided with a large head and large fins. Eight black patterns are distributed along the lateral line in somewhat irregular intervals and one occurs at the end of caudal peduncle.

Remarks: UCHIDA mentioned that *Belligobio eritigma* JORDAN et HUBBS, which is distributed in the western part of Honshû, closely resembles the present species from the original descriptions and figures. He has some doubt concerning the separation of the genus *Belligobio* from *Hemibarbus*. From these points, UCHIDA took *Belligobio eritigma* as a synonym of *Hemibarbus longirostris*.

Distribution: The present species is distributed in the western middle part of Honshû, Ueno, Mie Prefecture. Out side of Japan, it is also found in many rivers situated from the west of Rakuto-kô to Orryokkô in Korea. River Yoshino, Nara Prefecture (TA-

NAKA, AOYAGI); upper River Yura, Kyôto (MIYADI); Himeji, Hyôgo Prefecture; Okayama (JORDAN, HUBBS); Upper River Yoshii, Okayama Prefecture (MIYADI); upper River Kawai, River Enokawa, Hiroshima Prefecture (AOYAGI, Hiroshima Fisheries Station).

Genus **Biwia** JORDAN et FOWLER, 1903.

Type = **Biwia zezera** (*Pseudogobio zezera*)

Characters: Body elongate, compressed, rather thick, and somewhat broad forward. Head small, and below, together with the interorbital region, broad and flattened; snout bluntly rounded and produced; eye rather large; mouth small, inferior, the broad suborbitals overlapping on each side; no barbels; teeth, 5–5, interorbital space more or less flattened. Inside of gill-opening with a deep notch below. Intestine short. Peritoneum silvery. Scales large, imbricated, cycloid, and about 33; no scales on the breast. Origin of dorsal midway between tip of snout and base of last anal ray, the radii 7; anal short, the radii 6, and its origin behind tip of depressed dorsal; caudal emarginate; ventrals inserted about opposite the middle of the base of dorsal. Lateral line straight after the first 3 or 4 scales, and continuous.

The present genus is close to *Pseudorasbora*, the latter differing principally in the deep notch inside the gill-opening below. *Biwia* differs also in the form of the mouth, which is small, inferior, and ensheathed on each side by the broad suborbitals.

58. **Biwia zezera** (ISHIKAWA).
"Zezera"
(PL. XXIX, figs. 1–4)

Pseudogobio zezera ISHIKAWA, 1895, Zool. Mag., vii, pp. 127–128, figs. 4–7. - ISHIKAWA, 1897, Prel. Cat., 1897, p. 16.
Biwia zezera JORDAN et FOWLER, 1903, Proc. Nat. Mus, vol. xxvi, no. 1334, pp. 839–840.

The original description* is as follows.

Pseudogobio zezera n. sp. (?)

Jap. name Zezera. Loc. Otsu, Maebara, Matsubara.

D. 1/8; A. 1/7, L. later. 38, L. transv. 4½/3½

The height of the body is one-fifth the total length (without caudal), the length of the head a little less than one-fifth. The snout less extended than that of *P. variagatus*, with the front end more abruptly turned down than that species, making a rounded angle with the upper side of the snout. The eye much larger, the diameter of which being contained three and one-half times in the length of the head. Mouth inferior, horse-shoe-shaped, very small; barbels none, the lower jaw with pendant lateral lips. Origin of the dorsal fin much nearer to the end of the snout than to the root of the caudal

* ISHIKAWA, 1895, Zool. Mag., vol. VII, pp. 127–128, figs. 4–7.

as compared with *P. variegatus*.

The colouration is similar to that of *P. esocinus*. The ground color of the dorsal side of the head and body is shining yellowish ochre, that of the ventral side silvery. A series of round blackish blotches along the lateral line; a similar blotch is sometimes present on the occiput; and also along the dorsum. Three to four series of small black spots on the dorsal and ventral fins.

Pharyngeal teeth 5–5, arranged in two groups of three and two.

This species is thus very closely allied to *P. variagatus* from which it can be at once distinguished by its coloration and by its large eyes. As *P. variagatus* is the only species of *Pseudogobio* mentioned by GÜNTHER in his great work, that is devoid of any barbel, the present species may form the second species of the *Sarcocheilichthys* type of the genus, provided that no other species has became known since the publication of his catalogue vol. VII. The lack of sufficient literature on the subject makes it impossible for me to decide either on this point or on the novelty of the species.

Description: Head $4\,^1/_3$; depth $4\,^2/_5$; D. III, 7; A. III, 6; scales 33 in the lateral line; 4 scales between the origin of the dorsal and the lateral line, and 5 between the latter and the middle of the belly; pharyngeal teeth not examined, but probably 5–5; width of head $1\,^1/_2$ in its length; snout 4 in head; eye $3\,^2/_3$; interorbital space 3; pectoral a little less than head; ventral $1\,^1/_4$.

Body elongate, compressed, and somewhat broad forward. Head rather small, thick, and below, together with inter-pectoral region, broad and flattened; snout very bluntly rounded and produced; eye moderate, high, anterior, and a little longer than snout; mouth small, inferior, broad suborbitals overlapping on each side; lips very thin; no barbels; nostrils large, close together, on each side of snout, and the internasal space much less than interorbital space; flattened, the latter much broader than the eye. Gill-openings moderate, inside and below with a deep notch, gill-rakers very small and weak; pseudobranchiae small. Intestine short. Peritoneum silvery.

Scales large, cycloid, of more or less even size, and those on the sides imbricated; no scales on breast; no pectoral flap; no ventral flap.

Origin of dorsal about midway between tip of snout and base of last anal ray; the anterior rays the highest; base of fin about $1\,^1/_3$ in head; the length of fin, when depressed, $3\,^1/_3$ in body without caudal, and margin of fin convex; anal beginning well behind tip of depressed dorsal, or about midway between the origin of ventral and base of caudal, anterior rays the longest, base of fin short, and when depressed, the tip of fin reaches two-thirds the distance to base of caudal; caudal emarginate; pectorals with outher rudimentary ray enlarged and stiffened and reaching three-fourths of distance to ventrals; ventrals inserted about opposite the middle of base of dorsal, or a little nearer base of caudal than tip of snout, and reaching three-fourths of distance to origin of anal. Caudal peduncle compressed, its depth 2 in head. Lateral line almost straight, only slightly decurved upon the first three or four scales of its course.

Color in alcohol, brown, darker above, the lower surface pale or silvery; top of head and snout brownish; edge of each scale dark brown, so that a well-defined reticulated color pattern is present; fins all more or less grayish, the dorsal and caudal with some dark brown mottlings or blotches; a series of round dark blotches along the sides.

Length, $2\,^7/_{16}$ inches.

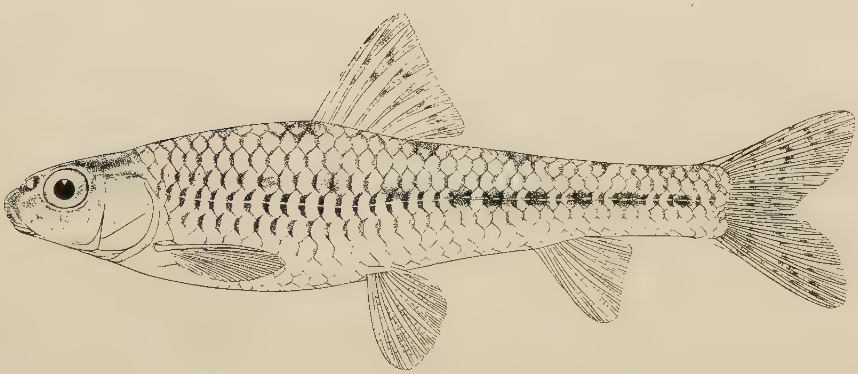


1

2



3



4

1. ***Biwia zezera*** (ISHIKAWA). ♂
2. ***Biwia zezera*** (ISHIKAWA). ♀
3. ***Biwia zezera*** (ISHIKAWA). ♂ ×4
4. ***Biwia zezera*** (ISHIKAWA), ♀ ×4

This description from an example from the River Yodo at Ôsaka, the only locality where the species was obtained by us. We do not hesitate to identify these specimens with ISHIKAWA's *Pseudogobio zezera*, as the characters in the main agree. However, he does not mention a notch inside the gill opening, a character also shared with *Pseudorasbora*.

Distribution: Lake Biwa; Ôtsu, Maebara, Matsubara, Zeze, River Tsuyama (ISHIKAWA).

Table 60. Measurements of *Biwia zezera* (ISHIKAWA).

Collection	O. H. B. S.*				
Total length	52. 0mm.	60. 0mm.	61. 0mm.	54. 0mm.	50. 0mm.
Body length	45. 5	49. 5	50. 0	46. 0	43. 0
Body length/Head	4. 21	4. 119	4. 35	4. 38	4. 09
Body length/Depth	4. 13	4. 31	5. 27	4. 18	3. 98
Body length/Predorsal length	2. 28	2. 36	2. 27	2. 36	2. 26
Body length/Prepectoral length	4. 07	4. 31	4. 35	4. 26	4. 37
Body length/Preventral length	1. 90	1. 83	1. 92	1. 84	1. 79
Body length/Preanal length	1. 30	1. 34	1. 28	1. 29	1. 30
Head/Snout	3. 28	3. 47	3. 29	3. 18	2. 92
Head/Upper jaw					
Head/Interorbital width	3. 60	3. 93	3. 84	3. 00	3. 50
Head/Diameter of Eye	3. 60	3. 93	3. 19	3. 50	3. 50
Head/Length of Caudal peduncle	1. 59	1. 69	1. 44	1. 57	1. 67
Head/Depth of Caudal peduncle	2. 40	2. 46	2. 56	2. 24	2. 62
Head/Length of Dorsal fin	1. 48	1. 57	1. 64	1. 50	1. 61
Head/Length of Anal fin	3. 86	2. 62	2. 30	2. 50	3. 00
Head/Height of Dorsal fin	1. 08	1. 02	1. 12	1. 03	1. 05
Head/Height of Anal fin	1. 74	1. 69	1. 55	1. 62	1. 75
Head/Pectoral length	1. 14	1. 18	1. 15	1. 07	1. 28
Head/Ventral length	1. 54	1. 53	1. 44	1. 54	1. 61
Date	V, 1938		VII, 1926		
Locality	Kobata Ike, Kyôto		Ôtsu, Shiga Prefecture		

* Ôtsu Hydrobiological Station, attached to Kyôto University.

Biwia tama OSHIMA*

Biwia tama OSHIMA, 1957, J. J. I., Vol. 6, Nos. 1-2, pp. 16-18, fig. 2.

The original description is as follows:

Biwia tama sp. nov. "Tamabaya" (new name)

Head 4,45 in length; depth 4,45; snout 3 in head; eye 4,50; interorbital space 3; depth of caudal peduncle 1,93; pectoral 1,50; ventral 1,50; D. 2,7; A. 1,6; P. 16; V. 9; scales in lateral line 43; 5 scales between origin of dorsal and lateral line, 5 scales between the latter and the middle of belly; pharyngeal teeth 4-4.

Body elongate, compressed, broadest at the insertion of dorsal; caudal peduncle eather deep; head rather small; snout blunt and rounded, median anterior part of nostrils markedly depressed; eye moderate, high and anterior; nostrils close together, in front of eye above; mouth small, terminal, slightly oblique, upper jaw longer than the lower, angle scarcely reaching a vertical through anterior edge

*The author has not opportunity to observe the specimens yet.

of anterior nostril; lips thick and fleshy, the broad suborbitals overlapping the angle of mouth on each side, anterior part of the lower jaw exposed; no barbels; interorbital space broad and convex, with a median longitudinal depression which extends forwards to the depression on the top of snout; gill-rakers on the first arch few and small, 2+4; peseudobranchiae present; pharyngeal teeth one-rowed, rather high and compressed with distinctly hooked tip.

Origin of dorsal nearer to tip of snout than the base of caudal, anterior ray the longest, 1,28 in head, the base of the fin 1,50, outer margin of the fin nearly straight; anal originated well behind the tip of depressed dorsal, rather short, anterior ray the longest, 1,80 in head, outer margin of the fin nearly straight; caudal bifurcate, tip of each lobe pointed; pectorals rather short, nearly as long as ventrals, extending a little beyond the midway to ventrals; ventrals inserted beneath the middle of the base of dorsal.

Scales large, cycloid, imbricated, of more or less even size; no scales on breast; pectoral and ventral flaps present; lateral line at almost straigh, very slightly decurved anteriorly.

Colour in formalin brownish gray above, paler and whitish below; sides maculated with dark brown; dorsal and caudal gray, tip of the former whitish, a black broad streak starts at the anterior threefifths of the fin, running obliquely backwards staining three anterior developed rays; pectoral gray; ventral and anal whitish.

Total length 122mm.

Described from a specimen collected at Denyenchôfu in May, 1952.

Remarks. - Hitherto known species included in the genus *Biwia* JORDAN et FOWLER is *Biwia zezera* (ISHIKAWA) known from Lake Biwa, Gifu, Nagoya and Asahi River, Okayama. The present species differs distinctly from the former in having 43 scales in the lateral line and 4-4 pharyngeal teeth instead of 5-5. At present a single specimen has been obtained in the type locality.

Genus **Pseudorasbora** BLEEKER, 1860.

Pseudorasbora BLEEKER, 1860, Act. Soc. Indo-Neerl. Japan, VI, p. 97.

Type = **Leuciscus parvus**

Characters: Body elongate. Head pointed, compressed; snout bluntly pointed; eye rather large, placed in or above the axis of the body, mouth terminal above, oblique, the mandible projecting, and the maxillary not reaching nostril; no barbels; teeth in one row, 5–5; interobital space broad and flat. Inside of gill opening with a notch below. Gill-rakers not fused. Intestine short. Peritoneum silvery. Scales large, cycloid, and about 38; breast scaled. Origin of dorsal nearer tip of snout than base of caudal; origin of anal begins below tip of depressed dorsal; caudal emarginate; ventrals inserted below origin of dorsal. Anal fin with 5 or 6 branched rays. No scaleless keel before the anal fin. Lateral line slightly decurved and continuous. Breeding males with the snout and sides of the head with horny tubercles.

Common in Japan, North and Central China.

59. **Pseudorasbora parva parva** (TEMMINCK et SCHLEGEL).
"Ishimoroko, Motsugo"
(PL. XXX, figs. 1–5; PL. XXXI, figs. 1–11).

Leuciscus parvus TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poiss., p. 215, pl. CII, fig. 3.
Leuciscus pusillus TEMMINCK et SCHLEGEL, Fauna Japonica Poiss., p. 216, pl. cii, fig. 4.

Pseudorasbora parva, KNER, Novara Fische, p. 355, pl. xvi, fig. 2. - GÜNTHER, 1868, Cat. Fish. Brit. Mus., VII, p. 186. - ISHIKAWA, 1875, Zool. Mag., xii, p. 128, - ISHIKAWA, 1897, Prel. Cat., p. 14. - JORDAN et SNYDER, 1900, Proc. U. S. N. M., xxiii, p. 344. - JORDAN et SNYDER, 1901, Anot. Zool. Jap., iii, p. 48. - JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, no. 4, p. 232. - TANAKA, 1921, Nihon Gyogaku, p. 189. - JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. vol. x, no. 2, p. 177. - UI, 1932, Kisyû Gyofu, p. 32, fig. 8. - OKADA, 1934, Sci. Rep. Tôkyô Bunrika Daig., sect. B. no. 28, pp. 30-35, pl. iv, fig. 1. - MIYADI, 1935, Kyôtofu Tansuigyo, pp. 30-31, pl. x, 25. - OKADA, MATSUBARA et UCHIDA, 1935, Nihon Gyorui Zusetsu, p. 82, pl. 27, fig. 1. - MIYADI, 1935, Fishes of Shinsyû, pp. 220-221, fig. 121. - NICHOLS, 1943, Freshwater Fishes of China, p. 101. - NIWA, 1954, Fishes of Kiso Valley, pp. 187, 239.

Pseudorasbora parva parva OKADA et NAKAMURA, 1948, Nihon no Tansui Gyorui, pp. 167-168, fig. 91.

The original description* is as follows:

Leuciscus parvus

Pl. CII, fig. 3.

Il nous reste à traiter de deux Cyprinoides du Japon, qui se reconnaissent facilement aux caractères suivants. Ils sont d'assez petite taille; leurs nageoires sont en génèral petites, et ils rappellent, notamment par leur bouche verticale, les Cyprinodons et les genres voisins, genres avec lesquels cependant on ne peut guère les confondre, attendu qu'ils n'ont que trois rayons à la membrane des ouies et que leur bouche n'est nullement armèe de dents.

Notre première espèce ne nous est connue que d'après un seul èchantillon; il est conservè dans la liqueur forte et ne passe guère deux pouces et demi en longueur. Ce petit poisson a le corps comprimé, de sorte que sa grosseur au commencement de la dorsale est deux fois et demie dans sa hauteur, qui elle-même entre trois fois et trois quarts dans la longueur comprise entre l'extrémité du museau et l'échancrure de la caudale. La tête occupe presque le cinquième de cette longueur. Le museau n'est guère plus considèrable que le diamètre de l'aeil et entre trois fois et demie dans la tête. L'entre-deux des yeux, enfin, est plus de moitiè plus large que le diamètre de cas organes. Les orifices de la narine s'ouvrent dans une cavité commune absolument surles cétés du dessus du museau, de sorte qu'elles sont presque tout à fait verticales; elles sont placées à égale distance du bout du museau et du bord de l'orbite. Le dessus de la tête est assez arrondi vers les cétés. La bouche trèsétroite étant qresque tout à fait verticale la mâchoire inférieure se dirige vers le haut lorsque le poisson ferme la bouche, et dépasse la supérieure lorsque la bouche se trouve ouverte. Le préopercule est petit, à angle obtus et arrondi; l'opercule est aussi fortement arrondi; La peau dont la tête se trouve revêtue, est une; mais elle est creusée sur le museau et à la mâchoire inférieure de plusieurs fossettes assez larges. La ligne latérale occupe le milieu du poisson; elle ne se dirige vers le haut que depuis la base des pectorales. Les écailles sont pasblement grandes, arrondies au bord, et à surface couverte de stries divergentes, peu serrées et à peine apparentes. On en compte 38 sur la ligne latérale, et il y en a 12 rangées entre le ventre et le dos, dont 5 se trouvent au dessus de la ligne latérale. L'anus s'ouvre immédiatement avant l'anale, sur la fin du deuxième tiers de la longueur comprise entre l'extrémité du museau et l'échancrure de la caudale.

Les pectorales naissent sur la ligne du bord inférieure de l'opercule; elles sont un peu arrondies; leur longueur égale la tête sans le museau; la distance entre leur extrémité et la base des ventrales est presque égale à la moitié de leur longueur. Les ventrales sont de même longueur que les pectorales; leur pointe est éloignée de la base de l'anale à une distance surpassant le tiers de leur longueur. L'anale est presque d'un quart plus courte que les ventrales, et plus basse par derrière que par devant; son bord inférieur est arrondi; de ses trois rayons indivisés et flexibles, le dernier égale le rayon

* TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poisson, p. 215.

mou suivant, est du double plus long que le deuxième, tandis que le premier est dur et caché sous les écailles. La caudale, fourchue au milieu, est divisée en deux lobes égaux. La dorsale nait vis-à-vis des ventrales; elle resemble a l'anale par sa forme et la nature de ses rayons, mais elle est plus élevée que cette nageoire, de sorte que sa hauteur égale presque la longueur de la tête. D. 3+7; A. 3+6; V. 1+7; P. 15; C. 19.

Ce petit poisson est de couleur argentée, passant au brun sur le dos. Les écailles des flancs se trouvent largement bordées de brun; mais ces bordures ne sont composées que d'innombrables petits points foncés. Les nageoires sont jaunâtres, mais elles sont plus ou moins teintes de noirâtre à leur moitié terminale.

Description: Head $4\,^1/_3$; depth 4; D. III, 7; A. II, 6; P. I, 13; V. 8; scales 38 in the lateral line; 5 scales between origin of dorsal and lateral line; and 5 between the latter and the middle of the belly; pharyngeal teeth 5–5; width of $1\,^2/_3$ in its length; snout $3\,^1/_2$ in head; eye $3\,^2/_3$; interorbital space a little less than half the head; pectoral $1\,^1/_3$; ventral $1\,^1/_3$.

Body elongate and compressed. Head pointed, the upper and the lower surface and sides more or less flattened; snout bluntly pointed; eye rather large; mouth obliquely vertical and projecting in front the maxillary protractile, and not reaching front of nostril; no barbels; pharyngeal teeth rather small and hooked; nostrils close together in front of eye above; interorbital space broad, nearly flat. Gill-opening moderate, lateral; gill-rakers merely fleshy rudiments; pseudobranchiae developed. Intestine short and with few turns. Peritoneum silvery.

Scales rather large, of more, or less even size, and cycloid; pectorals with a narrow, fleshy flap; ventral flap moderate, pointed.

Origin of dorsal anterior, nearer tip of snout that base of caudal, the anterior rays the highest, the base of the fin $1\,^1/_2$ in head, and the margin of the fin slightly convex; origin of anal much nearer tip of pectoral than base of caudal, small and similar to dorsal in shape; caudal emarginate, the lobes roundly pointed; pectorals reach about two-thirds the distance to ventrals; ventrals inserted below the origin of the dorsal and reaching two-thirds the distance of origin of anal. Caudal peduncle rather long; compressed, and a trifle more than the space between origins of pectoral and ventral. Lateral line almost straight, or only very slightly decurved, and continuous.

Secondary sexual character: Matured male is mostly larger than female. In the male, the pearl organs appear on the snout, mandible, maxillae, internasal space, interorbital space, margin of orbit, opercle, chin, occipital, dorsal, ventral, pectoral fins and on the scales. In the breeding season, the broad purplish black chromatophores appear on the outer margin of scales arranged on the lateral side of the male. The whole body including dorsal, ventral and anal fins is deep purplish black. The nuptial color already appears early in the beginning of December and in the middle of January. The both sexes are easily distinguishable by the color in this season.

Color in alcohol, very dark grayish brown or black above, the sides and lower surface more or less silvery, each scale with a brown spot; sides with a pale, slaty grey lateral band, most distinct posteriorly; alltthe fins grayish brown or black, and more or less indistinctly spotted or speckled with darker.

Color in fresh, ground color is light yellow, somewhat darker on the back and lighter on the belly; brown dark coloured longitudinal stripe running along the mid-line of the posterior part of body; black around the eye; dorsal fin dark yellow, with black patterns; pectoral light yellow.

Development: Egg: Diameter 1.84 × 1.49 mm.; with yellowish yolk. The incubation period lasts about 5–7 days at water temp. 21–23°C.

Larva: Newly hatched larva, total length, 5.14mm.; body length, 4.86mm.; greatest depth before vent, 1.06mm.; diameter of eye, 0.39mm.; head length, 0.89mm.; snout length, 0.14mm.; myomeres about 17 to vent plus 18 behind. Characterized by club-shaped yolk sac, consisting of a large bulbous portion and a narrow approximately extended posterior portion extending to vent. Mouth and vent not open; tail lophocercal; larval marginal fin continued around caudal to vent; pectoral developed but small.

Coloration: The larva is colorless, except large stellate chromatophores arranged in front of the middle of yolk sac to vent, and continued backward along ventral ridge to caudal. The eyes are metallic blue and black. The dorsal margin of air-bladder (incompletely formed) is darkly pigmented.

Larva 2-days old: Total length, 5.47 mm.; head length, 1.42 mm.; yolk sac almost reduced, retaining elongated, shaped; marginal fin fold intact; pectoral large; mouth and opercle begin to be movable.

Three days after hatching out, the yolk had been entirely absorbed, hence the larva swims about in the shoals to feed upon minute organisms. Colouration: Small yellow-

Table 61. Measurements of *Pseudorasbora parva parva* (Temminck et Schlegel).

Collection	O. H. B. S.*				
Total length	87.0mm.	76.0mm.	76.0mm.	71.0mm.	74.0mm.
Body length	71.0	60.0	60.0	57.0	59.0
Body length/Head	4.06	3.95	3.87	4.07	3.81
Body length/Depth	4.06	4.19	4.00	3.85	4.03
Body length/Predorsal length	2.09	2.07	2.00	2.02	2.03
Body length/Prepectoral length	4.31	4.13	3.75	3.88	3.68
Body length/Preventral length	2.15	2.00	2.04	2.03	2.00
Body length/Preanal length	1.48	1.43	1.46	1.45	1.40
Head/Snout Head/Upper jaw	3.07	3.38	3.10	3.50	3.10
Head/Upper jaw					
Head/Interorbital width	2.50	3.02	2.58	2.54	2.58
Head/Diameter of Eye	3.89	3.80	3.88	2.54	4.08
Head/Length of Caudal peduncle	1.17	1.21	1.19	0.97	1.29
Head/Depth of Caudal peduncle	2.06	2.01	2.12	2.15	2.28
Head/Length of Dorsal fin	2.06	1.90	2.21	2.54	2.15
Head/Length of Anal fin	3.30	3.04	3.60	3.69	3.10
Head/Height of Dorsal fin	1.19	1.09	1.19	1.09	1.22
Head/Height of Anal fin	1.70	1.69	1.82	1.82	1.72
Head/Pectoral length	1.46	1.48	1.48	1.45	1.52
Head/Ventral length	1.35	1.38	1.55	1.62	1.55
Date	VI, 1935		12, X, 1932		
Locality	Nichigetsutan Formosa		Kinohama		

* Ôtsu Hydrobiological Station attached to Kyôto University.

ish pigments make their appearance on the dorsal aspect, and a few large black chromatophores appear on the top of head.

Larva with 6.5 mm. body length (4–5 days after hatching out). Total length, 6.13 mm.; body height, 1.02 mm,; head length 1.40 mm.; diameter of eye, 0.58 mm.; snout length, 0.24 mm.; myomeres 20 to vent plus 15 behind. Head blunt; air-bladder large and apparent, composed of one chamber ($^{1}/_{10}$ length in total body length). Colouration: A few groups of sub-epidermal chromatophores appear on the gill region and large stellate black chromatophores distributed on the back of head are continued into two series running backward along the dorsal ridge to caudal. The air-bladder is covered on the dorsal side by dark grayish pigment and a few gray spots appear in the ventral lobe of caudal.

Juvenile with 8.2 mm. body length: Total length, 8.21 mm.; body length, 6.92 mm.; body height, 1.41 mm. head length, 1.93 mm.; diameter of eye, 0.68 mm.; snout, length, 0.39 mm.; mymeres 20 to vent plus 16 behind. Head heavy; snout pointed; mouth oblique, and lower jaw included. Rays appear in caudal, and dorsal fins rounded at the posterior margin. Marginal fin fold dersisting behind dorsal, however intact ventrally. Air-bladder 2-chambered. Colouration: Large black chromatophores make their appearance thickly on the dorsal aspect, and blownish ones occur on the snout, opercular and lateral regions. Other series of black chromatophores, which rise at the ventral aspect of opercle, run backwards and extend over the dorsal part of the intestine as well as on the ventral ridge.

Young with 21.9 mm. body length. Total length, 21.90 mm.; body length, 17.62 mm.; body height, 3.83 mm. Characterized by long snout and a small pointed mouth with sligtly projecting lower jaw, and rather large eye.

The young fish is almost fully scaled (of on the body 12.80 mm. long), and the fins well-developed and the long, caudal fin is deeply forked. Colouration: The chromatophores are distributed densely on both jaws, top of head, ventral margin of anal aspect, and on the dorsal region extending down to the sides of body. Characterized by a broad band from the tip of snout to base of caudal. The metallic faint yellowish colour covers the base of pectoral and extends to vent.

Habits: The fish mature in one year. The breeding season occurs in May around Tôkyô. The number of eggs in one individual may be counted generally about 300 and eggs are deposited at one time are about 50–60, for a long while. According to YABE's observation, the adult female selects a clear water course of 50–160 mm. depth to deposit eggs on the surface of the stones at the bottom. Before the action of spawning, the male makes an effort to clear even the surface of stones and also surrounding basin, about 130–310 mm. in width, by his fins. He wishes to protect the spawning ground and tempt females into mating action. May females are lured by a male and deposit eggs on the stones located in the middle of the spawning ground. The male charges the sperms on eggs after the eggs have been tightly attached to the stones they are guarded by a male. The matured egg is yellow and elliptical, measured about 1.5

PLATE XXX



1



2



3



4



5

1. ***Pseudorasbora parva parva*** (Temminck et Schlegel). ×1 ♀
2. ***Pseudorasbora parva parva*** (Temminck et Schlegel). ×1 ♂
3. ***Pseudorasbora parva parva*** (Temminck et Schlegel), with pearl organs. ♂
4. ***Pseudorasbora parva parva*** (Temminck et Schlegel). ×2.3 ♀
5. ***Pseudorasbora parva parva*** (Temminck et Schlegel). ×2.4 ♂

PLATE XXXI



Development of ***Pseudorasbora parva parva***, T. et SCH. after K. UCHIDA.

1. Eggs before segmentation, lateral views.
2. Embryo after 46 hours of fertilization.
3. Embryo just before hatched.
4. Embryo just hatched, 5.1mm. in body length.
5. Larva 7 days after 5.0 mm. hatched.
6. Juvenile 6.7 mm. in body length.
7. Juvenile measured 7.7 mm. in body length.
8. Juvenile 8.4 mm. in body length.
9. Juvenile 11.0 mm. in body length.
10. Juvnile 13.0 mm. in body length.
11. Young 15.4 mm. in body length.

mm. × 1.8mm. It hatches out in 12 days under the water temperature of 15.1° – 21.6°C. and in 5–7 days under the water temperature of 21° – 23°C. The just hatching out larva is 5.1 mm. in size and the yolk sac extends from the occipital to the anterior margin of anus. Three days after hatching out, the larva changes color into light yellowish green, nearly transpalent. From that stage, the juvenile fish begins to swim near the bottom. The young of 5 days after hatching absorbs the yolk sac entirely and takes the minute pelagic crustaceans. In the juvenile of 13 mm. body length, the black longitudinal stripe begins to appear from the snout to the base of caudal fin. This black stripe remains in some individuals, especially in the female.

This is a plankton feeder. The important food of the young fishes are mostly diatoms and green algae, such as *Fragilaria*, *Navicula* and *Eudorina* but when the fishes grow, the composition of the food changes to minute crustacea, i. e. *Daphnia*, *Cyclops*, as well as micro-plants *Diatoms*.

Type locality: Stream about Nagasaki.

Distribution: The present species is distributed in the south of the River Tone on the Pacific coast and in the south of nothern Niigata Prefecture. In the south of Japan it is extending to Kagoshima Prefecture, Kyushû. Ôtu; Maebara; Lake Biwa Matsubara (Ishikawa); River Yodo, Ôsaka; Lake Yogo; Sima; Zeze (Ishikawa); Karasaki, Lake Biwa (Jordan & Snyder); Nagasaki (Schlegel); River Yodo, Ôsaka; Lake Biwa, Matsubara (Jordan & Fowler); River Kati, Nagoya (Jordan); Kumamoto (Wakiya) Lake Mikata, Fukui; Lake Biwa at Ôtu (Jordan & Kawamura); Tsuchiura; Nagoya; Lake Biwa, Matsubara; River Iwai, Ichnoseki; River Chikugo, Kurume River Yodo, Ôsaka; Karasaki, Lake Biwa (Jordan & Fowler); Otsu, Lake Biwa; Maebara; Matsubara (Jordan & Snyder); Lake Suwa (Miyadi); Ena Valley, Kiso; River Kiso (Niwa); Hidaka-gun, Wakayama Prefecture (Ui); Kyoto (Miyadi); Western part of Honshû; Shikokû; Kyushû (Okada & Nakamura).

Remarks: Jordan and Hubbs* have mentioned that nuptial males have the pearl organs restricted to a single series along the sides of the cheeks, and to a series on the lower side of the head, inside the curve of the mouth. The writer also described the well-developed pearl organ on the snout, around eye and on the lower jaw of the present species.

60. Pseudorasbora parva pumila Miyadi.

"Shinaimoroko"

Pseudorasbora pumila Miyadi, 1930, Annot. Zool. Jap., xii, no. 2, p. 445, fig. 1, B. – Okada et Ikeda, 1938, Saitô Hô-on Kai Mus. Resear. Bull., no. 15, p. 93, pl. iv, no. 3.

Macrorasbora alineata Oshima, Saitô Hô-on Kai Mus., Notes, xxiv, p. 1.

The original description* is as follows:

Pseudorasbora pumila, sp. nov.

Head 3,6 to 3,9 in body length [1]; depth 3.3 to 3.7; eye about 4 in head; interorbital width 1.7 in head; height of caudal peduncle [2] 1,3 to 1,4 in its length[3]; D. 10; A. 8; scales in lateral series 34 to 35, in transverse series 10; teeth 5-5. Body elongate, rather rounded. Head depressed; mouth oblique, lower jaw projecting beyond the upper; no barbels. Caudal peduncle short, equal to the space between the origins of pectoral and ventral. Origin of dorsal anterior, nearer tip of snout than base of caudal. Scales large, rather uniform in size. Lateral line incomplete, being limited to anterior two to six scales only (fig. 1).

Color in formalin brownish, lower side being pale. The margin of each scale dark, and a dark band of a scale's width runs along the side of the body to the base of the caudal fin.

This species is a local representative of *Pseudorasbora parva* which is widely distributed in Japan proper, Formosa, Korea and China, and from the latter it is easily distinguished by the dwarfish form of the body, incomplete lateral line, the wide and flattened interorbital space, and the less number of scales.

Eight specimens of this fish were collected in Sinai-numa, Prov. Rikuzen. Following table gives the detailed measurements of *P. parva* from different localities and *P. pumila* from Sinai-numa.

Remarks 1. From a large number of specimens of Tôkyô Imperial University which Prof. S. TANAKA has kindly allowed me to examine, and my later collection I could ascertain that *Pseudorasbora pumila* is widely distributed in the northern Japan (Prefectures of Niigata, Gunma, Akita, Hukusima and Miyagi), and in some cases the lateral line is completely absent, but it does not appear in the southern Japan.

Remarks 2. In Fauna Japonica,[4] SCHLEGEL described a fish, *Leuciscus* (*Pseudobrsbora*) *pusillus*, near Nagasaki, which differs from *Leuciscus parvus* in its dwarfed form. JORDAN and SNYDER[5]), however, regarded the former to be inseparable from the latter. Among the fishes I examined a single specimen from the Tikugo River and five specimens from Formosa exhibit somewhat dwar fish nature, having deeper body and less number of scales (Table 2), and resembling closely the type of *L. pusillus* of SCHLEGEL. The specimens from Sinai-numa, which I described here as a new species, is more dwarfish in form than the type of *L. pusillus* and the specimen from the Tikugo River, and the lateral line is incomplete in the former.

Type locality: Sinai-Numa, Rikuzen.

Distribution: The present species is commonly known in the Tôhoku District excepting Aomori Prefecture; Sakata, Yamagata Prefecture; River Tone, Ibaraki Prefecture (AOYAGI); River Shinano, Niigata Prefectre (SUZUKI); River Kiso (NIWA). Kiso River; Sugadaira, Nagano Prefecture; Northern parts of Japan proper; Akita Prefecture; Yamagata Prefecture; Iwate Prefecture; Miyagi Prefecture (OKADA & IKEDA).

Remarks: TANAKA (1931) and MORI (1936) regarded the present species and *Pseudorasbora parva* (T. et SCH.) as identical. In the specimens preserved in the SAITO HO-ON KAI Museum, Sendai, Japan, two types of patterns are found: one has a blotch at the base of caudal fin, while the other has no such marking. *Pseudorasbora parva* seems

* JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 177.
1. Body length measured from the tip of upper jaw to the base of middle caudal ray.
2. Height of caudal peduncle measured at the middle of its length.
3. Length of caudal peduncle measured between the vertical from the base of last anal ray and the base of middle caudal ray.
4. Fauna Japonica, Poisson, 1846, p. 216, pl. 102, fig. 4; near Nagasaki.
5. Proc. U. S. Nat. Mus., vol. 26, 1903, pp. 840–841.

to be rare in the Tôhoku District, the northern part of Honshû and *Pseudorasbora parva pumila* takes its place.

Table 62. Measurements of *Pseudorasbora parva pumila* MIYADI.

Locality	Total length (cm.)	Head in length	Depth in length	Eys in head	Depth of caudal peduncle in caudal length	Scales in transverse series
Lake Biwa	5. 1	4. 0	3. 9	3. 9	1. 8	73
〃	4. 8	4. 1	4. 1	3. 6	2. 2	73
〃	4. 5	4. 0	4. 5	3. 5	2. 1	73
〃	7. 7	4. 2	4. 1	4. 0	2. 0	73
Kohata-Ike	6. 0	4. 1	4. 1	3. 5	2. 0	—
Kyoto	7. 8	4. 2	4. 1	4. 0	2. 0	38
〃	7. 2	4. 1	3. 9	3. 7	1. 8	37
River Yura	7. 5	4. 2	4. 2	3. 6	2. 0	37
〃	7. 3	4. 1	4. 2	3. 6	2. 0	38
〃	7. 7	4. 3	4. 2	3. 5	1. 8	—
Pref. Chiba	5. 7	4. 1	4. 3	4. 0	2. 0	38
〃	6. 0	4. 0	4. 3	3. 7	2. 0	37
Kasumigaura	8. 2	4. 2	4. 2	4. 0	2. 0	37
〃	7. 3	4. 1	4. 1	3. 9	2. 0	38
Korea [1]	7. 0	4. 1	4. 1	3. 6	1. 8	37
〃	6. 3	4. 0	4. 0	3. 6	2. 1	37
Manchuria [2]	8. 0	4. 3	—	3. 6	2. 2	37
〃	6. 7	4. 0	4. 0	3. 8	1. 9	37
Manchuria [3]	5. 8	4. 2	4. 4	3. 7	2. 0	38
Near Nagasaki [4]	8. 8	4. 1	3. 8	4. 0	1. 8	38
Mean	6. 7	4. 1	4. 1	3. 7	1. 9	37
Shinai-numa	6. 6	3. 6	3. 3	4. 0	1. 3	34
〃	5. 9	3. 8	3. 6	3. 9	1. 4	34
〃	5. 5	3. 9	3. 3	4. 0	1. 4	33
〃	5. 1	3. 7	3. 4	3. 8	1. 3	34
〃	4. 4	3. 9	3. 7	3. 5	1. 4	—
〃	4. 3	3. 8	3. 5	3. 3	1. 3	34
〃	4. 1	3. 7	3. 5	3. 5	1. 3	33
〃	4. 1	3. 8	3. 6	3. 8	1. 3	35
Mean	5. 0	3. 7	3. 5	3. 7	1. 3	34
Formosa [5]	5. 5	3. 7	3. 7	4. 0	1. 6	35
〃	5. 3	3. 7	3. 8	3. 5	1. 5	36
〃	5. 1	3. 7	3. 7	3. 8	1. 6	37
〃	4. 9	3. 7	3. 7	3. 9	1. 6	37
〃	4. 7	3. 7	3. 9	3. 7	1. 6	—
Chikugo River	6. 7	4. 0	3. 8	4. 0	1. 8	36
Near Nagasaki [6]	6. 9	4. 6	3. 6	4. 0	1. 8	37
Mean	—	3. 7	3. 7	3. 8	1. 6	36

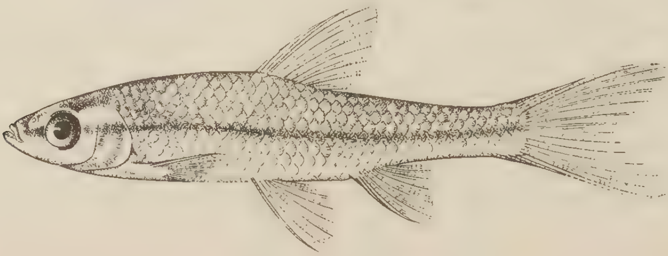
1. Suigen, Korea. 2. Mukden, Manchuria. 3. Liao-Yang, Manchuria. 4. Type specimen of *Pseudorasbora parva* (measured from original figure). 5. Karenkô, Formosa. 6. Type specimen of *Leuciscus pusillus*.

61. **Pseudorasbora parva uchidai** OKADA et KUBOTA.

"Hoso-Motsugo"

(Text-fig. 79)

Pseudorasbora parva uchidai OKADA et KUBOTA, 1957, Journ. Fac. Scie. Hokkaidô Univ., Ser. vi, Zoology, vol, 13, nos. 1-4; pp. 99-100, fig. 1.



Text-fig. 79. ***Pseudorasbora*** **parva uchidai** OKADA et KUBOTA. ×5/2

The original description* is as follows:

Pseudorasbora parva uchidai sub sp. nov. "Hoso-Motsugo"

Head 3.76 (3.68 to 3.89) in body length; depth 4.74 (4.56 to 5.19); width 7.52 (7.30 to 7.83); depth of caudal peduncle 9.40 (9.12 to 10.03). Eye 3.14 (3.05 to 3.53) in head; dorsal high 1.18 (0.99 to 1.20). Depth of caudal peduncle 2.8 (2.6 to 3.2) in caudal length.

D. III 7; A. II. 6; scales in lateral series 37 (36 to 38), but the lateral line incomplete at caudal portion; the same in transverse series 10; pharyngial teeth 5-5.

Body elongate with slender trunk, depth of caudal peduncle about three times in its length. Head depressed; eye very large; snout long, rather warp, equal or less to the diameter of eye; mouth small and oblique; the posterior margin of maxillary reaching slightly before the position coresponding the frontal region of nostril; lower jaw projecting beyond the upper; teeth small.

Scales large, rather uniform in size, but lateral line incomplete, being limited to posterior several scales only. Colour in life blackish above, lower side being pale. The margin of each scale scacely dark, a dark band running along the side of the body to the base of the caudal fin. Skull and head angles narrow.

Remarks: The above descriptions are based upon the twenty specimens obtained at Tsu City, Mie Prefecture. This new subspecies, *Pseudorasbora parva uchidai* has a more resemblance to *P. p. altipinna* distributing in China, but the former is easily distinguishable from the latter having the complete lateral line and the small number of dorsal rays. From the character of the incomplete lateral line, this new subspecies has coincided to *P. p. pumila* in Japan and *P. p. monstrosa* in China. It, however, is distinguishable from *P. p. pumila* with the scale number of lateral series, and lacking degree of lateral line organs and body form, and from *P. p. monstrosa* with the number of scales and dorsal rays.

* OKADA & KUBOTA, 1957: Journ. Facul. Scie. Hokkaidô Univ., ser. vi, Zoology, vol. 13, nos. 1-4; pp. 99-100, fig. 1.

Up to the present two distinct subspecies, *P. p. parva* and *P. p. pumila* are distributed in Japan, but the former is distinguished with the body from, smaller eye, complete lateral line, and distinct black marking on the margin of each scales.

It is well known fact that *P. p. parva* distinguised proportionally from the forms of themselves in complicance with the artificial change of living conditions. Therefore, they are composed by many local species (sub-species) with a remarkable variation of proportional characters. On the conclusion of subspecies of this group, we have made a suggestion as follows: It must be attached importance to the scale number of lateral series, the lacking degree of lateral line organs, the number of dorsal rays, and skull angle in adult specimen.

Type locality: Streams and ponds around Tsu City, Mie Prefecture, Japan.

Genus **Aphyocypris** GÜNTHER, 1868.

GÜNTHER, 1868, Cat. Fishes Brit. Mus., vii,p. 201.
NICHOLS, 1943, Fresh. Wat. Fish. China, p. 127.

Type = **Aphyocypris chinensis** GÜNTHER

Characters: Moderately large scaled, soft-finned, scaleless keel before the short anal fin, with about 7 branched rays. Lateral line incomplete. Dorsal fin short, without spines, opposite to the interspace between ventral and anal fins. Caudal forked. Snout with very thin lips; mouth oblique, terminal, jaws approximately equal or the lower projecting. Suborbitals rather broad. Barbels none. Upper jaw protractile. Gill rakers not fused. Pharyngeal teeth conical, hooked, in a double series. Anal origin behind the vertical form the end of the dorsal. Eye placed in or above the axis of the body.

62. **Aphyocypris chinensis** GÜNTHER.
"Hinamoroko"
(Text-figs. 80, a–b)

Aphyocypris chinensis GÜNTHER, 1808, Cat. Fishes Brit. Mus., vii, p. 201. - CHU, 1931, Biol. Bull. St. John's Univ., no. 1, 30. - UCHIDA, 1939, Tyôsen Gyoruishi, pp. 268–271, pl. 24, figs. 3-4. - NICHOLS, 1943, Freshwater Fish. China, pp. 127–128.

Type locality - Chekiang, China.

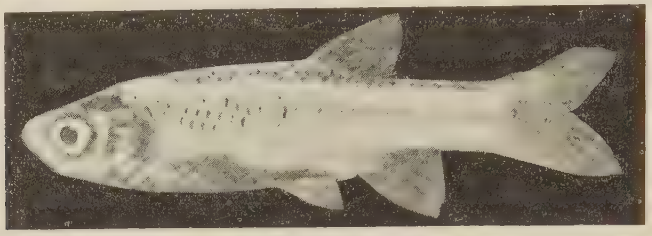
The original description* is as follows:

Aphyocypris chinensis GÜNTHER
D. 9, A. 9, V. 7, L. lat. 32, L. transv. 9.

The length of the head is contained thrice and two-thirds in the total (without caudal), the height

*GÜNTHER, 1868, Cat. Fishes Brit. Mus., vii, p. 201.

of the body four times. Head moderately compressed, the interorbital space being rather broad. The diameter of the eye is a little more than the length of the snout, or than one-fourth of the length of the head. The origin of the dorsal fin is behind the ventrals, and midway between the root of the caudal and the occiput. Cleft of the mouth subvertical, broad, of moderate width, the maxillary scarcely extending to the front margin of the orbit. Lower jaw scarcely projecting beyond the upper. Uniform silvery.



a



b

Text-figs. 80. a. ***Aphyocypris chinensis*** GÜNTHER, after K. UCHIDA. Young, 27mm. total length, Rakutokô, Korea.
b. ***Aphyocypris chinensis*** GÜNTHER, after K. UCHIDA. Adult, 45mm. total length, Chushinnandô, Korea.

Chikiang.
a. Twenty-two lines long. From Mr. Fortune's Collection.
Remarks: UCHIDA noted that *Hemigrammocypris rasborella* FOWLER (=*Brevigobio kawabatae* TANAKA) allied closely to the present species but differs from it by having more distinct skin ridges between the ventral fin and anus and three rowed pharyngeal teeth. The former species also have indistinct dark longitudinal band along the body side and incomplete lateral line running posteriorly from the middle of the body.

Genus **Tribolodon** SAUVAGE, 1883.

Acahara JORDAN et HUBBS, 1925, Mem. Carn. Mus., Vol. x, No. pp. 179-178.

Characters: Body elongated, somewhat compressed; head nearly conical, bluntly pointed; snout slightly projected beyond the mouth; mouth opens obliquely, lower jaw slightly shorter than upper jaw. Lips smooth on surface, without barbels. Gill opening broad, on lateral side; branchial membrane united with the narrow region. Pharyngeal teeth in two rows, branchiostegales short, pointed at ends; pseudobranchiae well-developed. Alimentary canal short; abdominal wall light brown. Dorsal fin short, inserted on the middle of body or somewhat posteriorly, just opposite to the ventral; anal fins inserted somewhat posteriorly from the dorsal fin. Seven branched rays in the anal fin.

Scales small, 60–100 on the longitudinal line, elliptical, the center somewhat situated to the base, the radii well developed on apical and lateral regions. Rings somewhat rough, appear on the entire circle. Lateral line complete, broadly and shallowly curved downward. Freshwater or blackishwater fishes distributed in the northeastern regions of Asia.

Key to the Japanese species of Tribolodon

a¹. Barbels none; pharyngeal teeth 5-2/2-4, very rarely 5-2/1-4, recurved and hooked. Pseudobranchiae present. Dorsal opposite ventrals; ii, 8+1, rarely ii, 8 or ii, 9; anal fin short, ii, 9+1, rarely ii, 9 or 10. Scales cycloid, 60-98 in lateral line, 26-50 predorsal. Gill rakers rather short, 10-21 on first arch.

b¹. With 80-98 scales in lateral line.
With 38-50 scales predorsal; head long; gill rakers 15-21 .... **T. jusanensis**

b². With 60-82 scales in lateral line, rarely above 80. .... **T. hakuensis ezoe**

c¹. With less than 35-38 scales predorsal, head and snout rather short **T. hakuensis hakuensis**

c². With more than 35-38 scales predorsal, head and snout rather long
.... **T. hakuensis phalacrocorax** (landlocked form).

Remarks: The Japanese daces of the genus *Tribolodon* was first reported by A. Gunther in 1880, and up to 1937, species and subspecies have been recorded from Honshû and Hokkaidô.

1). *Leuciscus hakuensis* A. Günther 1880, (= *T. hakuensis hakuensis* (G.)).
2). *Tribolodon punctatum* M. H. Sauvage, 1880, (= *T. hakuensis* (G.)).
3). *Leuciscus taczanowskii* Steindachner, 1881, (= *T. taczanowskii* (St.)).
4). *Squalius japonicus* M. H. Sauvage, 1883, (= *T. hakuensis phalacrocorax*).
5). *Squalius caerulescens* M. H. Sauvage, 1883, (= *T. hakuensis hakuensis* (G.)).
6). *Leuciscus phalacrocorax* D. S. Jordan et H. W. Fowler, 1930, (= *T. hakuensis phalacrocorax* (T. et Sch.)).
7). *Phoxinus septentrionalis* Jordan et Seale, 1906, (= *T. hakuensis* (G.)).
8). *Acahara jusanensis* D. S. Jordan et C. L. Hubbs, 1925, (= *T. taczanowskii* (Steindachner)).
9). *Tribolodon hakuensis ezoe* Y. Okada et H. Ikeda, 1937.

These species above mentioned have been distinguished from the others principally by the difference in the number of the scales in the lateral line. But in the Japanese daces, the number of scales in the lateral line varies greatly, so Okada and Ikeda are inclined to look upon these differences as subspecific variations.

Sh. Tanaka, 1929–1931, combined four species, *L. hakuensis* G., *L. phalacrocorax* J. et F., *L. taczanowskii* St., and *A. jusanensis* J. et H., into one species, *L. hakonensis* Gunther.

L. S. Berg, 1912, regards *L. taczanowskii* St., as a synonym of *L. brandti* (Dybowski), and T. Mori, 1936, combines *Ph. septentrionalis* J. et S. and *L. phalacrocorax* J. et F. into *L. hakunensis* G.

But, against such an identification, the American authors, D. S. Jordan and H. W. Fowler, 1903, D. S. Jordan, Sh. Tanaka and J. O. Snyder, 1913, and D. S. Jordan and C. L. Hubbs, 1925, recognize the specific differences in each species.

63. Tribolodon hakuensis hakuensis (GÜNTHER).

Red fish, Red belly, Dace, "Ugui, Akauo, Ida"
(PL. XXXII, figs. 1–5; PL. XXXIII, figs. 1–14, Text-figs. 81, a–d)

Leuciscus hakuensis (GÜNTHER), 1880, Challenger Report, Shore Fishes, p. 72, pl. 31, fig. b. – STEINDACHER, 1881, Ichth. Beitr. p. 15. – JORDAN et SNYDER, 1901, Check List., p. 48. – TANAKA, 1921, Nihongyogaku, p. 191, fiig. 65. – JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., Vol. 26, No. 1334, pp. 846–848. – JORDAN et THOMPSON, 1911, Mem. Carn. Mus., Vol. 6, No. 4, pp. 232–233. – EBINA, 1931, Nihon Zyuyogyorui Zushu, Pl. 34.

Leuciscus hakonensis ISHIKAWA, 1895, Zool. Mag. Tokyô, p. 129. – MORI, 1936, Stud. Geogr. Dist. Fresh. Fish. East Asia, pp. 12, 17. – TANAKA, 1932, Gyogaku, p. 92.

Squalis caerulescens SAUVAGE, 1883, Bull. Soc. Philom. Paris, p. 3.

Squalis japonicus, SAUVAGE, 1883, Bull. Soc. Philom., Paris, p. 4.

Squalis hakuensis SAUVAGE, 1883, Bull. Soc. Philom., Paris, p. 4.

Phoxinus septentrionalis JORDAN et SEALE, 1906, Proc. U. S. Nat. Mus., xxx, p. 143, fig. 1.

Richardsonius caerulescens JORDAN, TANAKA et SNYDER, 1913, Jour. Coll. Sc. Imp. Univ. Tôkyô, Vol. 33, Art. 1, p. 72.

Richardsonius japonicus JORDAN, TANAKA et SNYDER, 1913, Journ. Coll. Sc. Imp. Univ. Tôkyô, Vol. 33, Art. 1, p. 72.

Richardsonius hakuensis JORDAN, TANAKA et SNYDER, 1913, Jour. Coll. Sc. Imp. Univ. Tôkyô, Vol. 33, Art. 1, p. 71. – TANAKA, 1911, Fig. Desc. Fish. Jap., I, p. 8, pl. II, fig. 8. – JORDAN et METZ, 1913, Mem. Carn. Mus., Vol. 6, No. 1, p. 18.

Richardsonius hakonensis KAWABATA, 1931, Biwakosan Gyokairui, pp. 34–35, pl. 2, fig. 11.

Acahara hakonensis JORDAN et HUBBS, 1925, Mem. Carn. Mus., Vol. 10, No. 2, pp. 178–179. – MIYADI, 1935, Kyoto Fuka Tansui Gyozokushu Mokuroku, p. 31, pl. 4, fiigs. 24, 24a.

Tribolodon hakonensis OKADA, UCHIDA et MATSUBARA, 1935, Fig. Desc. Fish. Japan, p. 87, pl. 32, figs. 2, 3. - OKADA et NAKAMURA, 1950, Nihon no Tansuigyorui, pp. 169–170, fig. 93.

Tribolodon hakuensis hakuensis IKEDA, 1934, Bot. & Zool., Vol. 2, No. 5, pp. 928-930, Tabs. 1–2. - SATÔ, 1935, Sci. Rep. Tôhoku Imp. Univ., 4th Ser., 10 (3), pp. 499–514, pl. 9, fig. 9. – OKADA SH., 1935, Zool. Mag. Tôkyô, Vol. 47, No. 566, pp. 778–783, figs. 1–6. – IKEDA, 1936, Zool. Mag. Tôkyô, Vol. 48, No. 7, pp. 48–54, pl. 1. – IKEDA, 1936, Bot. & Zool. Vol. 4, No. 9, pp. 1549–1552, figs. 1–6. – IKEDA, 1936, Zool. Mag. Tokyô, Vol. 48, No. 7, pp. 354–368, figs. 1–14. – OKADA et IKEDA, 1937, Zool. Mag. Tôkyô, Vol. 49, No. 5, pp. 161–172, figs. 1–6. – IKEDA, 1938, Zool. Mag. Tôkyô, Vol. 50, No. 4, pp. 183–184. – OKADA et MATSUBARA, 1938, Keys Fish & Fish-like Anim. Japan, p. 76. - OKADA, 1938, Sci. Rep. Tôkyô Bunrika Daigaku, Sec. B, No. 56, pp. 165, 192, fig. 11. – OKADA et IKEDA, 1938, Saito Ho-on Kai Mus., Res. Bull., No. 15, pp. 93–95, fig. 4.

Tribolodon punctatum SAUVAGE, 1883, Bull. Soc. Philom., Paris, p. 6. – JORDAN, TANAKA et SNYDER, 1913, Journ. Coll. Sc. Imp. Univ. Tôkyô, Vol. 33, Art. 1, p. 71.

The original description* is as follows:

Leuciscus hakuensis GÜNTHER

D. 10, A. 10, L. lat. 73, L. transv. 15/14. The height of the body is one-fourth of the total length (without caudal), the length of the head two-ninths. The diameter of the eye is one-fifth of the length of the head, and nearly two-thirds of the length of the snout or of the width of the interorbital space. The head is remarkably small, with narrow pointed snout, the cleft of the mouth being oblique and

* Report on the shore Fishes procured during the voyage of H. M. S. Challenger in the years 1873–1876, p. 72, pl. xxxi, fig. B.

Table 63. a. Measurements of *T. hakuensis hakuensis* (GUNTHER).

Reg. No.	Standard length	Depth Body in L.	Head in L.	Snout in H.	Eye in H.	Interobital space in H.	Maxillarie in H.
278mm.	194. 3mm.	? mm.	3. 9mm.	3. 1mm.	5. 0mm.	3. 0mm.	3. 4mm.
5005	188. 8	4. 7	3. 6	2. 9	4. 9	3. 1	3. 4
,,	216. 8	5. 1	3. 8	2. 9	5. 8	2. 9	3. 3
5503	90. 2	4. 3	3. 6	3. 2	4. 3	2. 8	?
5702	129. 3	4. 5	3. 9	3. 1	4. 4	3. 1	?
,,	134.	4. 4	4. 0	3. 0	4. 5	2. 9	3. 3
,,	151. 4	4. 5	3. 9	3. 1	4. 8	3. 1	3. 5
,,	170. 2	4. 5	3. 9	3. 2	5. 0	3. 1	?
10032	108.	4. 9	3. 5	3. 2	4. 3	3. 3	3. 3
11097	123. 3	4. 6	3. 8	3. 0	4. 9	2. 9	3. 3
,,	172. 7	4. 8	3. 8	2. 9	5. 1	2. 9	3. 0
,,	194. 5	4. 9	3. 9	3. 0	5. 6	2. 9	3. 2
11468	122.	4. 2	3. 8	2. 7	4. 4	2. 8	2. 9
,,	128. 8	4. 9	3. 6	3. 0	5. 0	3. 0	3. 2
15143	98. 6	4. 6	3. 6	3. 1	4. 5	2. 9	?
15962	101. 8	4. 5	4. 3	3. 1	4. 3	3. 0	3. 6
16123	92. 8	4. 8	4. 0	3. 3	4. 0	3. 2	3. 6
,,	121. 7	4. 3	3. 8	3. 1	4. 5	3. 0	3. 3
16201	137.	4. 6	3. 7	2. 9	5. 3	2. 7	4. 6
,,	150. 7	4. 4	3. 7	2. 9	5. 3	3. 1	3. 0
16399	186. 24. 2	4. 2	4. 0	2. 9	5. 2	2. 8	?
16801	2. 2. 5	4. 6	3. 8	2. 8	5. 7	2. 6	3. 5
16881	96. 8	4. 3	3. 8	3. 2	3. 9	2. 7	?
18187	156. 6	4. 3	3. 9	3. 1	5. 1	3. 1	3. 2
,,	171. 1	4. 3	3. 9	3. 0	5. 2	2. 9	3. 3
,,	173. 0	4. 5	4. 0	3. 1	5. 3	3. 1	3. 3
	175.	4. 3	3. 7	3. 0	6. 1	3. 3	3. 3
18187	180. 5	4. 7	4. 1	2. 9	5. 3	3. 2	3. 5
,,	183. 8	4. 6	4. 0	3. 1	5. 4	3. 1	3. 6
,,	184. 4	4. 4	4. 1	3. 0	5. 0	3. 3	3. 0
,,	196. 2	4. 2	4. 0	3. 0	5. 3	3. 1	3. 4
,,	200.	4. 3	3. 7	3. 0	5. 4	3. 1	3. 4
,,	207. 3	4. 5	3. 9	3. 1	5. 8	3. 2	3. 5
,,	211. 6	4. 4	4. 0	3. 0	5. 7	3. 0	3. 3
,,	229. 8	4. 4	3. 9	2. 8	6. 1	3. 0	3. 3
1820. 5	102. 5	4. 7	3. 7	3. 1	4. 2	2. 8	?
18260	97. 8	4. 6	3. 7	2. 9	4. 3	3. 1	?
20125	128.	4. 1	3. 9	2. 9	4. 8	2. 9	3. 3
20156	138. 4	4. 0	3. 8	3. 0	5. 2	2. 8	?
20199	125. 9	4. 2	3. 8	3. 1	4. 8	2. 9	3. 2
,,	129	3. 7	3. 7	3. 0	5. 1	3. 0	3. 2
25084	169. 8	4. 1	3. 5	3. 1	5. 4	3. 1	3. 3
26100	104. 6	4. 2	4. 1	3. 0	4. 5	?	?
26604	135. 3	5. 2	3. 6	3. 0	4. 7	3. 0	?

not reaching to the front margin of the eye. Upper jaw overlapping the lower. Origin of the dorsal fin above the root of the ventrals, midway between the snout and the root of the caudal fin; fins generally small and short, the pectoral being not much more than one-half of its distance from the ventral. Scales very distinctly striated; there are eight longitudinal series between the lateral lineand ventral fin. Pharyngeal teeth 5/2, pointed. Coloration uniform.

This species is infested by a large *Ligula*, like so many other Cyprinoids of the old world. Length of specimens, 7½ and 9½ inches. Lake Hakone, Japan.

Description: Body elongated, compressed. Head elongated, pointed and compressed, the sides flattened, and the upper profile almost straight to the tip of the snout; snout rather pointed, somewhat broad and slightly produced; eye small, anterior, 1 1/2 in

Table 63. b. Measurements of *T. hakuensis hakuensis* (GUNTHER) (continued).

Depth caud. Ped. in H.	Numbers of fin rays D.	A.	Numbers of scales Predorsal	In L.L.	Above L.L.	Below L.L.
2.7	11,8	11,8+1	37	78	16	12
2.6	11,8	11,8+1	33	71	16	13
2.6	11,8	11,8	33	68	14	11
2.6	11,8	11,9	30	71	15	11
3.6	11,8	11,8+1	33	71	15	10
2.6	11,8+1	11,8+1	31	73	15	11
2.6	11,8	11,8	34	73	14	10
2.5	11,8+1	11,8+1	30	73	14	11
3.1	11,8+1	11,8+1	35	73	16	11
2.6	11,8+1	11,8+1	37	73	15	11
2.6	11,8+1	11,9	31	73	14	11
2.6	11,8+1	11,9	32	69	15	11
2.6	11,8	11,9	33	72	15	11
2.9	11,8	11,9	30	72	14	11
2.7	11,8	11,9	32	72	14	10
2.6	11,8	11,9+1	33	69	16	10
3.1	11,8	11,9+1	33	69	15	10
2.5	11,8	11,9+1	33	71	16	12
2.7	11,8+1	11,9	34	75	15	11
2.5	11,8+1	11,9	32	73	15	11
2.2	11,8	11,9	31	69	15	11
2.5	11,8+1	11,9	34	78	16	11
2.5	11,8+1	11,8+1	33	67	16	12
2.5	11,8+1	11,9+1	34	68	15	10
2.4	11,8	11,9+1	39	72	15	11
2.4	11,8	11,9+1	32	72	15	12
2.6	11,8+1	11,9	28	67	14	12
2.6	11,8	11,9	28	72	15	11
2.5	11,9	11,9	32	73	15	13
2.3	11,8+1	11,10	27	75	14	11
2.5	11,8	11,9	29	69	15	12
2.3	11,8+1	11,9+1	30	62	14	11
2.5	11,8+1	11,9	28	79	15	11
2.4	11,8	11,9	33	72	15	11
2.4	11,8	11,9	31	69	15	11
3.0	11,8	11,9	33	67	15	9
2.6	?	?	33	76	14	12
2.5	11,8	11,8+1	31	70	14	10
2.3	11,8	11,8	32	74	16	11
2.6	11,8	11,8	35	72	14	11
2.6	11,8	11,9	34	73	14	12
2.6	11,8+1	11,9	31	72	15	10
2.7	11,8	11,9	31	78	14	12
3.0	11,8	11,9	33	74	14	12

snout. Mouth moderate, subinferior, the maxillae protractile, not extending to vertical through anterior rim of the eye; lips fleshy, not dilated. Pharyngeal teeth 5, 2–2, 4, with grinding surface hooked; nostrils close together on the sides of the snout, and about, half an eye diameter distant from the eye; interorbital space convex. Gill rakers on first gill-arch rather short pointed, 3 + 9; pseudobranchiae developed. Dorsal fin inserted midway between the tip of the snout and the base of the caudal fin; anal fin inserted beind the base of the dorsal fin; pectoral fin moderate, without flap, two-thirds the distance to ventral fins; ventral fin inserted slightly before the dorsal fin, with a fleshy flap; the caudal fin emarginate, the peduncle rather long, its least depth $2\,^1/_4$ in the head, the lobes pointed. Scales cycloid, 74 in lateral line, 14 scales between the

origin of dorsal and lateral line, and 14 scales between the latter and middle of belly. Lateral line slightly decurved and continuous. Intestine short. Peritoneum pale gray.

Color in formalin dark brown above, pale below; anal and ventral fins pale; dorsal fin and caudal fin brown.

Sexual differences: Sexual differences seem to be present in the length and the stiffness of the paired fins, the shape of the urinogenital papilla, the number and the size of the pearl organs, and the distinctness of the nuptial coloration. The proportional differences of the depth of body, of the length of head, of the length of snout, of the diameter of eyes and of the depth of caudal peduncle seem to have no connection with the sex. In the breeding compared with the brackish water form.

The pearl organs appear a little later than the appearance of the nuptial color. They are found distributed in the three different areas of the body as described below.

1). On the head and face: the organs are seen only on the internasal space and parietal regions of the head. In the brackishwater form, the organs appear on the tip of snout, internasal space, parietal regions of head, cheeks, opercles, and branchiostegal bones.

2). On the rays of the fins; the organs are found on the rays of the pectoral, dorsal, anal and caudal fins. In the male of both the brackish and freshwater forms, the organs are found on each fin. The female of the brackish-water form has the organs in the form of low tubercles arranged on the rays of each fin, excepting for the anal fin. In the freshwater form, the organs are generally not found on each fin, but, in the form

Table 64. Measurements of *Tribolodon hakuensis hakuensis* (GÜNTHER).

Collection	Fish. Mie Univ.*			
Total length	136. 0 mm.	159. 0 mm.	157. 0 mm.	162. 0 mm.
Body length	109. 0	130. 2	130. 4	133. 2
Body length/Head	3. 70	4. 00	4. 08	4. 04
Body length/Depth	5. 00	4. 57	4. 83	5. 07
Body length/Predorsal length	1. 91	2. 04	2. 03	1. 96
Body length/Prepectoral length	3. 97	4. 20	4. 10	4. 04
Body length/Preventral length	1. 98	2. 10	2. 07	1. 98
Body length/Preanal length	1. 42	1. 46	1. 47	1. 43
Head/Snout	3. 69	3. 25	3. 48	3. 33
Head/Upper jaw	4. 10	3. 70	3. 68	3. 59
Head/Interorbital width	3. 22	3. 25	3. 13	3. 40
Head/Diameter of Eye	4. 34	4. 52	4. 78	4. 92
Head/Length of Caudal peduncle	1. 24	1. 15	1. 18	1. 21
Head/Depth of Caudal peduncle	2. 27	2. 50	2. 71	2. 68
Head/Length of Dorsal fin	2. 92	2. 60	2. 67	2. 80
Head/Length of Anal fin	3. 10	2. 76	2. 74	2. 58
Head/Height of Dorsal fin	1. 57	1. 47	1. 57	1. 50
Head/Height of Anal fin	2. 05	2. 35	2. 16	2. 23
Head/Pectoral length	1. 65	1. 63	1. 62	1. 61
Head/Ventral length	2. 06	1. 96	1. 98	2. 00
Date	27, V, 1955			
Locality	Lake Biwa, Shiga Prefecture			

* Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

of indistinct tubercles, may be rarely found on the anterior rays of the pectoral and dorsal fins.

3). On the scales: In the male, the pearl organs are distributed on the surface of the trunk, excepting for the narrow zone extending from the posterior margin of the operculum to the anal fin. In the female, they are found on the dorsal side of the trunk in several longitudinal rows. They are also on the ventral side of the body, the area between the pectoral and anal fins being excluded. The arrangement of the pearl organs on the scales covering the dorsal surface of the body differs with the form of the fish. In the brackish water form, a few of the organs are arranged on the surface transversely; while in the freshwater form, the same are arranged longitudinally. Judging from the spawning habits, mentioned in the chapter on the habits of this species, the pearl organs seem to season, the body of the female becomes temporarily thicker and deeper than that of the male. In the male, the pectoral, the ventral and anal fins are longer and broader than those of the female. Generally, in the male, the urino-genital papilla on the cloaca is thicker than that of the female. In the female, the posterior edge of this opening is closer to the anal fin, and the muscular lobe on the ventral side of the rectum is more well-developed than that of the male. In the breeding season, the nuptial coloration and the pearl organs appear both on the male and the female. But in general, the nuptial color of the female is less distinct, and the pearl organs in the female are less in number and smaller in size. According to SATO's[1)] description, in the territories near Sendai, Miyagi Prefecture, the nuptial color appears in the latter part of March and may be seen until the middle of June. During the period from the middle of April to the middle of May, it attains its highest development. When the breeding season approaches, the reddish orange color begins to appear first on the edges of the upper and lower jaws, on the cheek, operculum, ventro-lateral portions of the body and also on the proximal portion of each fin. Then two narrow reddish lines appear, one running above the lateral line and other running along the same. The black color also develops on the head and dorso-lateral portions of the body, excepting the areas colored red. The black and red colors develope to a high degree. In the female, the colors are less distinct compared with those of the male. Futhermore the nuptial colors are variable in the individuals and in the specimens from the different localities. The distinguished sexual characters appear more distinctly in the freshwater form as serve as cotact organs, holding the bodies of both sexes very close together, and thus give to the eggs laid by the female some certainty of meeting with the sperms discharged by the male.

Sex ratio: According to SHU OKADA's[2)] observations, the female is much less numerous than the male. The ratio is shown 14 (♀) to 168 (♂).

Development: According to SHU OKADA's descriptions, egg is dermersal and adhesive, measuring 2.5 mm. in diameter. The ovulation occurs several times, about 600–

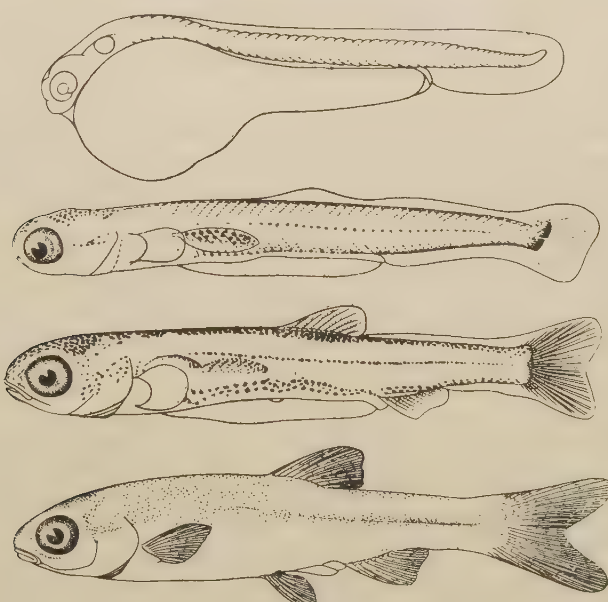
1). SATÔ, M. 1935, Note on the nuptial coloration and pearl organs of *Tribolodon hakuensis* (GÜNTHER), Sci. Rep. Tôhoku Imp. Univ., 4th Ser. Biology, pp. 499–513.
2). OKADA, SHÛ, 1935, Zool. Mag., 47 (566), pp. 780–781, table 1.

4000 eggs on one time. The incubation period is about 11–13 days when the waier temperature is $10.0^\circ \pm 0.5^\circ$C. From my own experiments, the egg measures 2.5 to 3.1 mm. in diameter, and incubation requires 7 to 9 days at waters temperature of $125^\circ \pm 1.0^\circ$C. The egg is spherical with a yellow yolk mass, attached together loosely to gravel.

Young: Newly hatched larva, total length 6.7 mm.; length to vent 4.4 mm.; myomeres 31 to vent plus 18 behind (incomplete). The larva is colorless with a very large yellow club-shaped yolk sac. This stage lasts about 25 days. Larva with 9.6 mm. body length: Total length 9.65 mm.; body length 7.95 mm.; body height 1.12 mm.; head length 1.50 mm.; diameter of eye 0.71 mm.; snout length 0.22 mm.; myomeres 27 to vent plus 19 behind.

Body elongated; eye large; mouth terminal and oblique. Pectoral fins appear merely as fin folds, rays developed in the slightly forked tail, and the position of the dorsal fin is indicated by a concentration in the marginal fin fold beginning over the twenty-second myomere. Colouration: at this stage there exist many melanophores on the top of the head. These are arranged in an irregular double series running along the dorsal ridge from the head to the caudal fin. A few occur on the cheek, snout, and on the lateral line in a single series. There are large stellate chromatophores along the ventral margin of the body beginning just in front of the vent and extending to the caudal fin.

Pigment also appears over the one-chambered air-bladder and on the dorsal side of the intestine.



a

b

c

d

Text-fig. 81. Larva and juveniles of ***Triboldon hakuensis hakuensis*** (GÜNTHER).
a. Newly hatched larva, 6.7 mm. long.
b. Juvenile of 9.6 mm. long.
c. Juvenile of 14.7 mm. long.
d. Young of 19.9 mm. long.

Juvenile of 15.7 mm. body length: Total length 15.75 mm.; body length 12.45 mm.; body height 2.22 mm.; head length 3.22 mm.; diameter of eye 1.10 mm.; snout length 0.61 mm.; Body moderately stout; head rater large; snout pointed; caudal heterocercal and rayed. Ventral is developing; larval marginal fin fold persisting behind dorsal and nearly complete on ventral aspect. Colouration: The pigmentation of the young is essentially the same as that of the previous stage, plus a few stellate melanophores on the dorsal fin, ventral aspect, snout and jaws, and over the two-chambered air-bladder. Iridocyte, metalic blue chromatophores appear on the ventral region of the body from the vent to the opercle.

Young with 19.9 mm. body length: Total length 19.97 mm., body length 17.00 mm.; body height 3.44 mm.; head length 4.65 mm.; diameter of eye 1.49 mm., snout length 1.20 mm.. All of the fins completely formed. The young fish attains this stage about 2 months after hatching.

Breeding: This species is a spring breeder, seeking the upper region of streams over clean gravels. During the breeding season the males have distinct pearl organs and nuptial coloration. The spawning behavior has already been studied by SHU OKADA (1934).

Habits: According to the spawning behavior observed by SATO, M.[1] in Lake Osore Zan, Aomori Prefecture, the breeding season extends from the latter part of May to the beginning of July, and during this season the mature male and female migrate in shoals from the lake, with purpose of performing the spawning when they ascend to the upper part of the river where the males discharge their sperms and the females and the females lay their eggs.

In the act of spawning, the male and female are set side by side in close contact continuing about several seconds, during this action the eggs are laid by the female and the sperms are discharged by the male with a quivering vibration of the posterior half of the body. Frequently a single female is spawning together with two or more males. SHU OKADA,[2] described the spawning habits of the present species found in the Chitose River, Hokkaidô. Breeding occurs during May and June, and during this season, the fish gather in small groups of up to ten individuals according to species, and ascend to the upper parts of the rivers in large numbers to spawn on the river bottom in shallow to fairly deep water.

It is a very interesting phenomen on that a lot of *T. hakuensis hakuensis* (*Leuciscus hakonensis*) are found in a small pond at Daitoku temple, built about 800 years ago, located at Kitazawa, Yokoyama village, Motoyoshi gun, Miyagi Prefecture. This pond is only connected with a small stream of the River Kamo and with a spring which supplies the water for the pond. In all seasons they are fed rice by the daily vistitors to the temple, but they do not breed in the pond. When the breeding season bigins, they swim out from the pond and descend to a main branch of the river. During the breeding

1). SATÔ, MITSUO, 1935, Sci. Rep. Tôhoku Imp. Univ., 4th Ser., 10 (3), p. 512.
2). OKADA, SHÛ, 1935, Zool. Mag., 47(566), pp. 778–783, figs. 1–6.

season, there are no fish in this pond.

Food habits: NORIO, SUEHIRO investigated the food of the adult (*Leuciscus hakonensis*) collected at River Edo on June 20, 1933 and at Lake Kizaki, Nagano Prefecture on August 5, and 10, 1934. He suggested that the fish is somewhat omnivorous and voraceous. In a lake sample, they feed mostly on *Cladocera* and in a river sample, on larva of *Diptera*. They also feed on phytoplankton (*Calothrix*, *Spirogyra*, *Oscillatoria*) and zooplankton (Dipteran larva, Odonata larva, Ephemeridan larva, *Arthrostraca*, *Phyllopoda*, *Copepoda*, *Oligochaeta*, *Polychaeta*). From the result of feeding habits, we suppose the fish may have adaptations for various different freshwater regions. The author examined 36 young specimens measuring from 10–22 mm. in body length. The young with body lengths of 10–12 mm. contained chiefly micro-algae and small *Rotifers* in the alimentary canal. In the young of 16–18 mm. body lengths, the food is composed of aquatic microplants and crustaceans (*Bosmina*, *Alona*, etc.), as well as aquatic insects (mostly *Chironomidae*). In the later immature stages, various kinds of small aquatic animals, such as shrimps, insects and small fishes were abundants in the alimentary canal.

Type Locality: Hokou (Hakone).

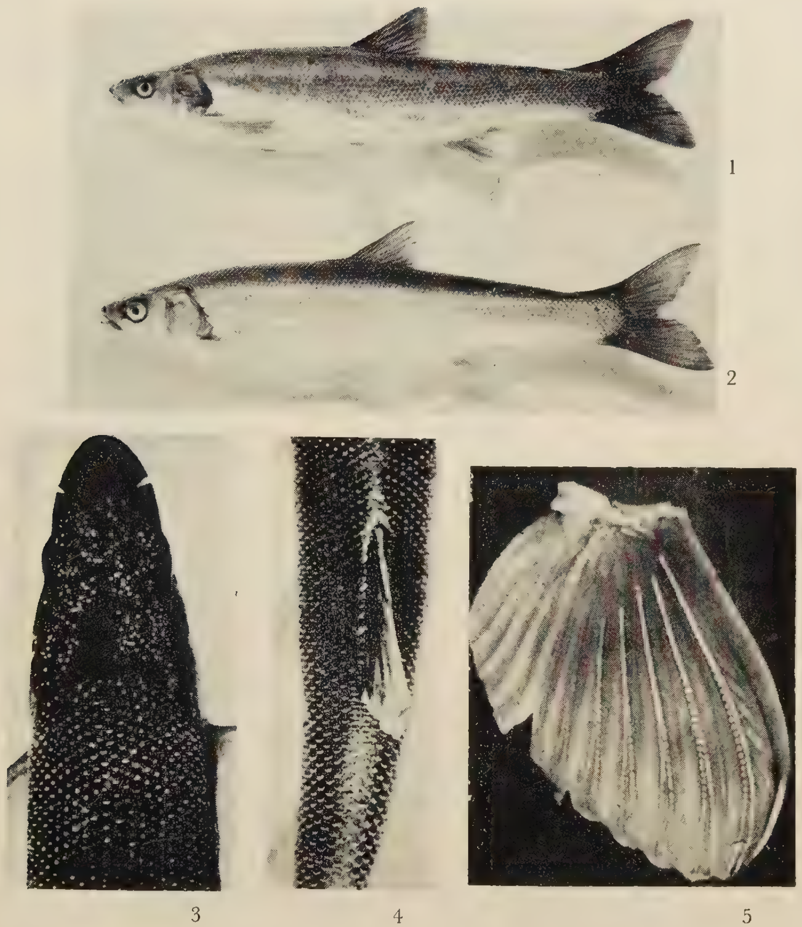
Distribution: Lake Hakone (GUNTHER); Japan, Korea, Saghalien (JORDAN, TANAKA, & SNYDER); Tôkyô market (JORDAN); Hamada (WAKIYA); Lake Kawaguchi (WAKIYA & ISHIKAWA); Lake Yamanaka (WAKIYA & ISHIKAWA); Nagano (NAKANO); Himeji (ABE); Okayama (MIKAMO); Akita; River Hiki, Kishû (KUROIWA); Lake Kisaki (OTA); Aomori (BEPPU); Toyama (YOSHIZAWA); Noo (MORIOKA), Awaya, Lake Tôgô, Tottori (INOMATA); Kamishibi, near Fukui; Lake Mikata Fukui; Lake Suwa (JORDAN); Lake Biwa (JORDAN); Lake Hakone (JORDAN); Lake Kawaguchi; Aomori; Morioka; Otaru; Lake Yamanaka; Drainage of Sea of Japan; Ebisu, Sado Island; Lake Biwa; Nagano; Drainage of Inland Sea; Lake Hakone; Tôkyô Market (JORDAN & HUBBS); Lake Chûzenji; River Kinu, Utsunomiya; Minakami, River Tone; Maehashi; River Iruma branch stream of River Ara; River Eppe branch stream of River Ara; Kumagaya; River Tama; Reservoir Yamaguchi; River Sagami; Atsuki; (OKADA); Lake Ashi, Hakone (R. TANAKA); spot off Kanagawa (Imp. Fish Inst. Tôkyô); Lake Osorezan, Aomori Bay; Lake Zyusan, River Soma, Aomori Pref.; Lake Hachirô; River Omono; Lake Tazawa Akita Pref.; River Mogami; River Oshida; Hinata, Tsuruoka Yamagata Pref.; River Budô, River Miomote, Iwafune, Niigata Pref.; Higashiyama, Kotani, Fukushima Pref.; River Chikuma, branch of River Shinano, Lake Kizaki, Nagano Pref.; River Sai, Kanazawa, Ishikawa Pref.; Matsue, Shimane Pref.; Lake Ogahara, River Mabuchi, Aomori Pref.; River Shizukuishi, branch of River Kitakami; River Kitakami Iwate Pref.; Lake Bagyu, River Okada, Matsushima Bay, River Hirose, Sendai Pref.; Abukuma, Fukushima Pref.; Lake Sei, Yamanashi Pref.; River Katsura upper part of River Sagami, Kanagawa Pref.; Yugashima Shizuoka Pref.; Lake Suwa, Nagano Pref.; River Kiso, Fukushima Pref.; River Ôta, Wakayama Pref.; River Yoshino upper part of River Ki, Nara Pref.; Lake Biwa, Shiga Pref.; River Yoshino, Tokushima Pref.; Kôchi, Kôchi Pref.; River Ôita, Ôita Pref.; River Omaru Takanabe, Miyazaki Pref.; River

Ôsumi, River Sendai, Kagoshima Pref.; River Takase, upper part of River Chikugo, River Hita Chikugo, Kumamoto Pref.; Lake Akan, Lake Tofutsu, Lake Sokin, Lake Abashiri, Lake Nottori, Lake Toro, River Chitose, Yoichi Hokkaidô (Okada & Ikeda); Ôtsu, Lake Biwa (Ishikawa); Lake Biwa (Sauvage); River Soma Naka Tsugaru, Taya Higashitori Shimokita, Aomori Pref.; Lake Tazawa Senhoku, Hachirogata Tenno Minami Akita, Akita Pref.; River Shizukushi, Morioka, Hirota Kesen,, Iwate Pref.; Nabire Wakuya Toda, brook near Hôyô-in Sendai, River Okada, Shichigo, Bagyu Karita, off Karakuwa Motoyoshi, River Hirose, Sendai, off Karakuwa Motoyoshi, Motomachi River, Kesenuma; River Naruse Niima Mamigun Miyagi Pref.; River Tsuruoka, River Hyûga, Yamagata Pref.; Coast of Konahama Iwaki, River Araumi Tajima Aizu, Kitakata Yama-gun, River Abukuma Fukushima, Fukushima Prefecture (Okada & Ikeda); Lake Biwa; Hita Province, Kasumigaura Hitachi Province; Tôkyô; Gifu; Imaegata Kaga Prov.; Hashimoto Kishû Prov.; Ina Shinshû Prov.; Matsumoto Shinshû Prov.; Hakone, Uyeda Shinshû Prov.; Kôchi Tosa, River Tate; Toyokawa-mura, Buzen Prov.; Takagi-mura, Naka-gun, Iwami Prov.; Tomita Suwo Prov.; Tachikawa Bushû Prov.; Sendai, Prov.; Kinosaki Tajima Prov.; Shimozuke Prov.; Shimamura Swa Kozuke Prov. (Tanaka); Lake Jusan, Aomori Prof., Kawajiri, Rikuchû Prov.; River Kitakami; Rikuchû Prov.; River Katase, Enoshima Kanagawa Pref.; Matsushima Bay, Rikuzen Prov.; Same, Mutsu Prov.; Aomori, Mutsu Prov.; River Kitakami, Morioka; Sendai, Miyagi Pref.; Niigata Echigo, River Iwai, Ichinoseki, Tsuruga Echizen, River Kinu, Utsunomiya; Hakodate Hokkaidô; Otaru Hokkaidô; Karasaki; Lake Biwa; Noishiro; Hiroshima; a lake near Oida, Yokohama (Jordan & Fowler); Yokohama (Jordan & Snyder); Lake Biwa (Sauvage); Lake Hakone; Hakodate; Yokohama; Lake Biwa (Jordan & Snyder); Matsubara; Lake Biwa; Hakodate; Sendai (Jordan & Thompson); River Kanko, Fusan, Chinnampo (Jordan & Metz); Lake Biwa (Kawabata); Japan; Korea; (Jordan, Tanaka & Snyder); Lake Biwa (Jordan, Tanaka & Snyder); Matsubara, Lake Biwa; Hakodate ?; Sendai (Jordan & Thompson).

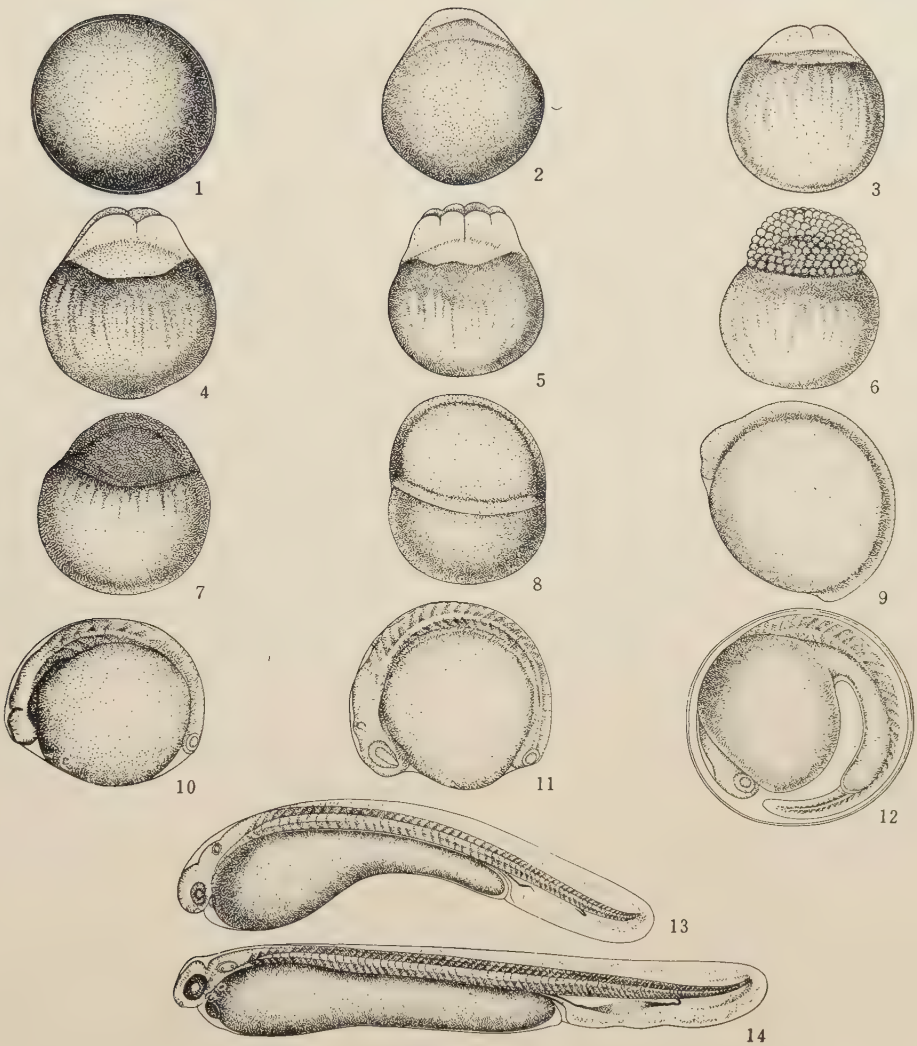
Remarks: The present species is very widely distributed and many specimens show slight differences of outer features and scale numbers in various localities. Ikeda noted in his report on statistical observations on the species of the genus *Tribolodon* in Japan and some notes on the distribution[1)] that Jordan and Seale reported one new species of the genus *Phoxinus*, *Ph. septentrionalis*, from Aomori. He judged from the description and the original figure that *Ph. septentrionalis* J. et S. does not seem to belong to the genus *Phoxinus*, but to the genus *Tribolodon*. However this species seems to be distinguishable from *T. hakuensis hakuensis* (G.) in having a larger eye and a dark longitudinal line on the side of body. Speaking from his observations, the proportional value of the diameter of the eye seems to gradually diminish with the growth of the fish, and the dark longitudinal line on the side of body is usually present in the young examples belonging to *T. hakuensis hakuensis* (G.), so the specific character of *Ph. septentrionalis* J. et S. seems to

1). Ikeda, H. 1938, Sci. Rep. Tôkyô Bunrika Daigaku, Sec. B, No. 56, Vol. 3, pp. 176–177.

PLATE XXXII



1. ***Tribolodon hakuensis hakuensis*** (GUENTHER). ♂
2. ***Tribolodon hakuensis hakuensis*** (GUENTHER). ♀
3. Pearl organs on the head of ***Tribolodon hakuensis hakuensis*** (GUENTHER). ♂ ×Ca. 3.
4. Pearl organs on the body of ***Tribolodon hakuensis hakuensis*** (GUENTHER). ♂ ×Ca. 3.
5. Pearl organs on the rays of pectoral fin of ***Tribolodon hakuensis hakuensis*** (GUENTHER). ♂× Ca. 3



Development of ***Tribolodon hakuensis hakuensis*** GUNTHER.

1. Unferfilized egg.
2. Ferfilized egg.
3. Two cell stage, 2.5° after fertilization.
4. Four cell stage, 3° after fertilization.
5. Eight cell stage, 4° after fertilization.
6. 32-64 cell stages, 6° after fertilization.
7. Morula stage, 8° after fertilization.
8. Blastula stage, 20° after fertilization.
9. Early embryo formation.
10. Embryo with 8-9 myotomes and Kupfers vesicle.
11. Embryo with 12 or more myotomes and optic vesicle.
12. Embryo with 22 myotomes and auricle vesicle, just before hatching out.
13. Larva just hatched, 6-6.3 mm total length.
14. Larva of 7.7-7.8 mm in total length, with black pigments on eye and body.

have the juvenile characteristics of *T. hakuensis* (G.). Since IKEDA agreed with D. S. JORDAN and C. L. HUBBS (1925), he suggested that *Ph. septentrionalis* T. et S. is the young form of *T. hakuensis hakuensis* (G.). IKEDA also noted in the same paper that according to the description; *Tribolodon punctatum* S. appears to be distinguishable from his examples of *T. hakuensis hakuensis* (G.), in having a shorter head and a shallower depth, but such differences are negligible because SAUVAGE's measurements are given in percent of the total length of body, while IKEDA's measurements in percent of the length of body exclusive of the caudal fin. Also, besides SAUVAGE's record, no reliable report upon the occurrence of the present species in Lake Biwa are know. He feels inclined to consider that *T. punctatus* S. is a synonym of *T. hakuensis hakuensis* (G.).

In 1934, IKEDA mentioned the correlation between the variations of scale number and the caudal length and body height from many specimens found in streams and rivers at Iwafune-gun, Niigata Pref., around the River Miomote. He has found a definite relation of the body height and caudal length to the degree of maturity. In 1938, IKEDA held lectured on the *Tribolodon* of Japan at the 13th Zoological Congress in Hokkaidô, and classifid Japanese species into 7 species and subspecies from the characters of the number of scales on the lateral line, number of scales anterior to the dorsal fin, number of scales above the lateral line, head length, and snout length. Thus the following species and subspecies were mentioned: *T. taczanowskii* (STEINDACHNER), *T. hakuensis hakuensis* (GÜNTHER), *T. hakuensis phalacrocorax* (JORDAN et FOWLER), *T. hakuensis ezoe* OKADA et IKEDA, *T. hakuensis punctatus* SAUVAGE, *T. hakuensis* var. ? *T. medius* OSHIMA. SH. TANAKA (1931) combined *T. taczanowskii* (STEINDACHNER) and *T. hakuensis phalacrocorax* (JORDAN et FOWLER) with the present species. SAUVAGE mentioned *Tribolodon punctatum* from a specimen collected at Lake Biwa in 1883 and from his original des-

Table 65. Scale Number of *Tribolodon hakuensis hakuensis* (GÜNTHER) in different located specimens.

Localities	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	Average
Lake Kawaguchi	1	—	—	—	—	2	2	—	—	—	1	—	—	—	—	—	—	—	—	70.3
Aomori, Morioka, Otaru	—	—	—	1	2	—	4	2	1	2	1	1	—	—	1	—	—	—	—	72.3
Lake Yamanaka	—	—	—	—	—	—	1	2	1	—	2	1	—	—	—	—	—	—	—	73.4
Dranaige of Sea of Japan	—	—	—	1	—	—	—	2	2	1	2	3	4	—	1	1	—	—	1	74.7
Ebisu, Sado Isl.	—	—	—	—	—	—	—	1	—	—	2	1	—	—	—	—	—	—	—	74.5
Lake Biwa	—	—	—	—	—	—	2	—	—	—	4	4	1	—	—	—	—	—	—	74.8
Nagano	—	—	—	—	—	—	—	1	1	—	2	1	—	—	1	—	—	—	—	75.7
Dranaige of Inland Sea	—	—	—	—	—	—	—	—	1	1	—	—	2	—	1	—	—	—	—	76.0
Lake Hakone	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	78.0
Tôkyô Market	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	2	—	—	—	79.0
Totals	1	—	—	2	2	2	9	8	6	4	14	12	9	—	4	3	—	—	1	74.5

cription that will be included under the synonyme of *Tribolodon hakuensis hakuensis.* The author and IKEDA [1] treated the species of the genus *Tribolodon* of Hokkaidô, Japan from the statistical observations and the geographical distribution after the grand collections of the specimens from Hokkaidô. The senior author recognized 4 species and subspecies: *T. hakuensis hakuensis*, *T. hakuensis phalacrocorax*, *T. hakuensis ezoe*, *T. jusanensis.* IKEDA[2] has described an example of deformity of the present species with a rod-shaped left pectoral fin, collected in Lake Akan, Kushiro Province, Hokkaidô. JORDAN and HUBBS[3] noticed the variation of scale numbers *Acahara hakonensis* collected from several different localities. The materials from many Japanese rivers show fewer scales on the average, not more, as currently indicated, than is characteristic of true *hakonensis.* They compiled the table of the scale number variation as follows. (Table 63).

64. Tribolodon hakuensis phalacrocorax (JORDAN et FOWLER).

"Tsumari ugui"

(Text-fig. 82)

Leuciscus phalacrocorax JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., 26, p. 845, fig. 7 (Type locality: Tama River & Tachikawa) – TANAKA, 1921, Nihongyogaku, p. 191.
Richardsonius phalacrocorax JORDAN, TANAKA et SNYDER, 1913, Jour. Coll. Sci., Tôkyô, p. 72, fig. 46.
Acahara phalacrocorax, JORDAN et HUBBS, 1925, Mem. Carn. Mus., 10, no. 2 p. 180.
Tribolodon hakuensis phalacrocorax OKADA et IKEDA, 1937, Zool. Mag., Tôkyô, XLIX, no. 5, p. 161 – OKADA et IKEDA, 1938, Saitô Hô-on Kai Mus., Res. Bull., no. 15, pp. 95-96, tab. 6.

The original description* is as follows:

Leuciscus phalacrocorax JORDAN et FOWLER

Head 3 5/6; depth 4 3/4; D. III, 8; P. 17; V. 9; scales about 62 in the lateral line; 12 scales between origin of dorsal and lateral line, and 12 between latter and middle of belley; pharyngeal teeth 2, 5-4, 3; width of head 2 in its length; snout 3 1/2 in head; eye 4 1/2; interorbital space 3; pectoral about 1 1/3; ventral 1 2/3.

Body elongate and compressed. Head elongate, pointed, compressed; the sides somewhat flattened, the upper profile slightly convex; snout rather long, pointed and slightly convex and produced; eye small, anterior, a 1 1/3 in snout; mouth nearly horizontal, only slightly inclined; the maxillae protractile, and reaching posteriorly to the anterior margin of the eye; lips fleshy, not dilated; pharyngeal teeth with narrow grinding surface, slightly hooked; nostrils close together on the snout above and nearer the eye than the tip of the snout; interorbital space and top of head convex. Gill-openings large, gill-rakers short, and firm; pseudobranchiae present. Intestine short. Peritoneum black.

Scales cycloid, rather large, more or less even, and not imbricated; no pectoral flap; a small ventral flap. Origin of the dorsal fin midway between the tip of snout and the base of the caudal fin, the first developed ray the highest, reaching beyond the others to the origin of the anal when depressed, the base of the fin 1 2/3 in its height, and its upper edge nearly straight; origin of the anal fin a little

1). OKADA and IKEDA, 1937, Zool. Mag., Vol. 49, No. 5, pp. 161–172.
2). IKEDA, 1936, Bot. & Zool., 4 (9), pp. 1549–1552, figs. 1–6.
3). JORDAN and HUBBS, 1925, Mem. Carn. Mus., Vol. 10, No. 2, p. 179.
*JORDAN and FOWLER, 1903, Proc. U.S. Nat. Mus., 26, p. 845,

nearer the tip of the pectoral than the base of the caudal, the first developed ray the longest, reaching beyond the others when the fin is depressed, and its base 1½ in its height, and its margin nearly straight; the caudal fin deeply emarginate; pectoral fin reaching a trifle over two-thirds the distance to the origin to the ventral fin; the ventral fin seven-ninths the distance to the origin of the anal. The caudal peduncle rather long, compressed, and its least depth 2½ in head. Lateral line slightly decurved, and continuous.

Color in alcohol dark slaty brown, whitish or silvery beneath; dorsal and caudal fins brownish, pectoral fins also tinted with brown, all the other fins pale; a dark blotch along the gill-opening above the base of the pectoral fin.

Table 66. Measurement of *Tribolodon hakuensis phalacrocorax* (JORDAN et FOWLER).

Reg. No.	Standrard length	Body depth	Head	Snout	Eye	Interorbital space	Maxillae
	mm.	in L.	in L.	in L.	in H.	in H.	in H.
278mm.	182. 4mm.	4. 4	3. 9mm.	2. 9mm.	5. 1mm.	2. 9mm.	3. 4mm.
11097	109. 3	4. 4	3. 3	3. 0	4. 8	3. 0	3. 1
11861	154. 4	4. 4	3. 9	2. 9	5. 1	?	?
16385	99. 8	4. 6	3. 8	3. 0	4. 2	2. 9	?
—	104. 0	4. 4	3. 5	3. 3	4. 6	3. 6	3. 8
18187	149. 6	4. 3	3. 6	3. 1	5. 1	3. 1	3. 3

* JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., 26, p. 845.

Table 67. Measurements of *Tribolodon hakuensis phalacrocorax* (JORDAN et FOWLER) (continued).

Depth caud. ped.	Number of fin rays		Number of scales			
in H.	D.	A.	Preoral	In L. L.	Above L.L.	Below L.L.
2. 5 mm.	II,8	II,8	30	60	15	12
2. 7	II,8+1	II,9	30	68	13	10
2. 5	II,8	II,9+1	28	64	15	10
2. 7	II,8	II,8	27	65	13	11
2. 8	II,8	II,8	32	64	14	13
2. 5	II,8+1	II,10	29	64	15	10

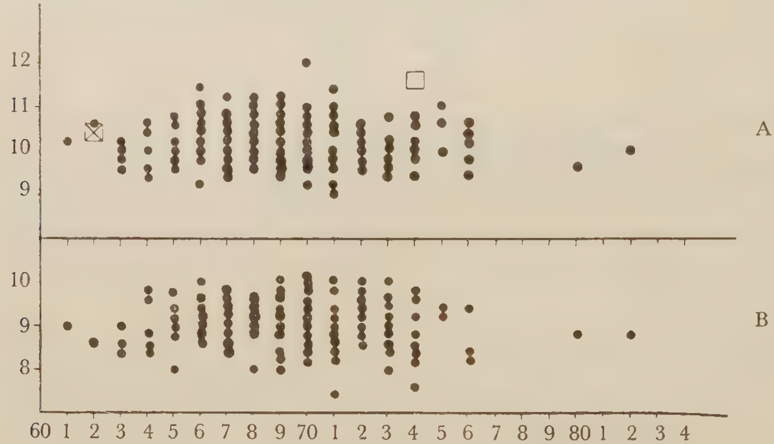
Type locality: Tama River & Tachikawa.

Distribution: River Tama & Tachikawa; Kôshû; River Kinu, Utsunomiya (JORDAN & FOWLER); River Tama; River Kinu, Kôshû; Kasumigaura; Fukui; River Mogami; River Omono; River Yoneshiro; Lake Osoreyama; Lake Akan, Hokkaidô; Aomori Pref.; Iwate Pref.; Miyagi Pref. (OKADA & IKEDA); River Soma; Nakatsugaru; Lake Osarezan, Shimokita, Aomori Pref.; River Shizukuishi, Iwate-gun, Kamiyonai, Morioka, Zyanoshima, Iwate Pref.; River Hirose, Sendai, Miyagi Pref. (OKADA & IKEDA).

Remarks: In the length of head, the interorbital space and depth of caudal peduncle, all the specimens collected by IKEDA[1)] quite agree with the description of *Tribolodon*

1). IKEDA, H. 1938, Sci. Rep. Tôkyô Bunrika Daigaku, Sec. B. No. 56, pp. 163–192.

hakuensis phalacrocorax J. et F., and appear to be distinguished from *T. hakuensis hakuensis* (G.). In the diameter of eye, the specimens collected at a spot off Kanazawa agree with *T. hakuensis* (G.) but the specimens of the other localities agree with *T. hakuensis hakuensis* (G.). In the depth of body, two series belonging to *T. hakuensis hakuensis* are *T. hakuensis phalacrocorax* J. et F. are intermixed, but the specimens are rather more like *T. hakuensis phalacrocorax* J. et F. In the scales in and above the lateral line, two series belong to *T. hakuensis hakuensis* (G.) and *T. hakuensis phalacrocorax* J. et F. are quite intermixed, so the two species cannot be clearly distinguished from each other by the differences of the scacls alone. The correlation between the scales on and below lateral line of the two species *T. hakuensis hakuensis* and *T. hakuensis phalacrocorax* wa shown. This shows the length of head in percent of the standard length in relation to the scales in the lateral line, based upon the observations of 292 specimens from the Kantô District of Honshû. (□ *T. hakuensis hakuensis* (G), ◆ *T. hakuensis phalacrocorax* J. et F.).



Text-fig. 82

It shows the depth of caudal peduncle in percent of the standard length in relation to the scales in the lateral line, based upon the observations of 292 specimens from the Kanto District of Honshû. (□ *T. hakuensis hakuensis*, ◆ *T. hakuensis phalacrocorax*). The characters of this figure show the distinction between *T. hakuensis* and present species.

The above figures show the number of scales below and above the lateral line of *T. hakuensis hakuensis* and the present species. In the scales above the lateral line two series belonging to *T. hakuensis hakuensis* and the present species are quite intermixed, so the two species cannot be clearly distinguished from each other by the difference of the scale number. In the scales below the lateral line, we could not see any difference between the two species.

Phoxinus - The type of *Phoxinus* differs from *Leuciscus*, in its incomplete lateral line and very small scales. In the latter respect the subgenus *Hemitremia* forms a complete transition to *Leuciscus*, and some of its species (as *margarites*) have the lateral line scarcely defective. Considering all the known species, *Phoxinus* can not be separated from *Leuciscus*.

It may even be necessary to mege *Rutilus* and its American representatives. *Leucus* and *Myloleucus*, in the same great group. Lateral line more or less incomplete; small species, the males usually brilliantly coloured, the sides and belly red in spring.

Phoxinus (phoxino-minnow; from tapering) the old name of the European "minnow" *Leuciscus phoxinus*.

65. Tribolodon jusanensis (JORDAN et HUBBS).

"Jusan Ugui"

Leuciscus taczanowskii JORDAN et FOWLER, 193, Proc. U. S. Nat. Mus., vol. 26, p. 848.
Tribolodon taczanowskii OKADA et IKEDA, 1938, Sci. Rep. Tôkyô Bunrika Daigaku, Sect. B, No. 55, p. 149.
Acahara jusanensis JORDAN et HUBBS, Mem. Carn. Mus., Vol. 10, No. 2, p. 180.
Tribolodon jusanensis OKADA et IKEDA, 1937, Zool. Mag., Vol. 49, No. 5, p. 162.

The original description* is as follows:

Leuciscus taczanowskii

Head 4, depth 4 2/3; D. III, 7; A. III, 8; P. 17; V. 10; 16-20 scales above the lateral line, and 38-50 scales anterior to dorsal fin and middle of belly; pharyngeal teeth 5, 2-2, 4; width of head 2 1/3 in its length; snout 3 1/3 in head; eye 5 3/4 in head; interorbital space a little over 3; pectoral 1 1/2; ventral 2.

Body elongate and compressed. Head elongate, pointed, compressed, and the sides flattened; upper profile of head almost straight to tip of snout; snout long, rather blunt and scarcely projecting beyond the mandible; eye small, anterior, 1 3/4 in snout; mouth moderate, the maxillary protractile, not reaching posteriorly as far as the eye, and not very oblique; lips fleshy, not dilated; pharyngeal teeth

Type locality: Lake Jusan, Aomori. Tohutsu Lake.

Table 68. Measurements of *Tribolodon jusanensis* (JORDAN et HUBBS).

Locality	Numb.	Numb. Scales in Lat. Line	Numb. Scales below Lat. Line	Numb. Scales in Lat. Line
Lake Abashiri, Hokkaidô.	1	93	13.0	17.0
Lake Mokoto, Hokkaidô.	1	90	12	17.0

Numb. Scales before Dorsal	Head Length	Snout Length	Eye Diam.	Body Length	Height Caudal-peduncle
44.0	27.4 mm.	8.6 mm.	3.4 mm.	23.4 mm.	10.6 mm.
42.0	27.4	9.5	4.6	22.4	10.5

* JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., vol. 26, p. 848.

with grinding surface, slightly hooked; nostrils close together on the upper sides of the snout, and much nearer the anterior edge of eye than tip of the latter; interorbital space and top of the head rather broad and slightly convex. Gill-openings large; gill rakers short, 4+10; pseudobranchiae present. Intestine with a single convolution; peritoneum silvery.

Scales very small, cycloid, and of more or less even size; no pectoral flap; a small ventrall flap. Origin of dorsal fin nearer the base of caudal than tip of snout, the first developed ray the highest reaching beyond the others to the origin of the anal when depressed, the base of the fin 1 2/3 in its height and its margin nearly straight; anal inserted midway between tip of pectoral and base of caudal fin, the first developed ray the highest reaching beyond the others when depressed, the base of the fin 1 1/4 n its height, and its margin nearly straight, caudal fin deeply emarginate, the lobes pointed. Pectoral fin reaches about two-thirds the distance to ventral; ventral fin inserted slightly before the origin of the dorsal, and reaches two-thirds the distance to anal. Caudal peduncle long, its least depth 2 2/3 in head. Lateral line slightly decurved, and continuous.

Color in alcohol dark brown, slightly olivaceous above, the lower surface of the body pale or whitish; dorsal, caudal, and pectoral fins grayish or brownish black, the other fins pale.

Distribution: Lake Abashiri, Lake Mokoto, Lake Tohutsu, Hokkaidô (OKADA et IKEDA); all parts of Hokkaidô, northern part of Japan proper, Sakhalin, Maritime, northern coast of the sea of Japan of Korea (OKADA et IKEDA).

66. Tribolodon hakuensis ezoe OKADA et IKEDA.

"Ezo ugui"

Tribolodon hakuensis ezoe OKADA et IKEDA, 1937, Zool. Mag., vol. 49, no. 5, pp. 161-162. - OKADA, 1938, Cat. Vert. Jap., p. 145.

Description: Standard length 133.9mm.. Depth of body, 20.5%, length of head 27.2%, length of snout 9.9%, diameter of eye 5.5%, interorbital space 9%, depth of caudal peduncle 10%. D. II, 8, I; A. II, 9. Scales in lateral line 71; 17 above, 14 below, 39 predorsal. Gill rakers 13. Teeth 5-5/2-4.

Distribution: Lake Ônuma, Lake Penke, Lake Panke, Lake Akan, Lake Tohutsu, Lake Mokoto, upper region of River Abashiri, Lake Toro, Nagatsunuma, River Chitose Hokkaidô (OKADA & IKEDA).

Table 69. Measurements of *T. hakuensis ezoe** OKADA et IKEDA.

Locality	Specimen number	Scales above L.L.	Scales below L.L.	Scales on L.L.	Scales front
Lake Ônuma	26	71.5	12.0	18.0	39.2
Lake Penke	21	73.3	12.3	17.0	38.1
Lake Penke	95	72.2	12.1	17.1	37.7
Lake Akan	56	72.8	12.5	17.6	39.2
Lake Tôfutsu	7	74.1	12.4	17.9	40.7
Lake Mokoto	6	76.5	12.0	16.7	38.2
Abashiri River	15	71.7	11.5	17.4	37.8
Lake Toro	2	73.5	12.5	17.5	40.5
Osatsunuma	2	74.0	12.0	17.0	41.0
River Chitose	34	73.5	12.5	17.2	39.8

Table 70. Measurements of *Tribolodon hakuensis ezoe* OKADA et IKEDA (continued).

Head length	Snout length	Eye diam.	Body height	Caud. Ped. height
28. 3mm.	9. 8mm.	5. 1mm.	22. 7mm.	10. 8mm.
28. 1	9. 6	5. 7	22. 4	10. 5
28. 0	9. 3	5. 8	22. 4	10. 5
28. 6	9. 9	5. 1	22. 2	10. 6
27. 2	9. 8	4. 8	22. 6	11. 2
26. 5	9. 2	5. 2	23. 3	10. 5
28. 5	9. 5	6. 0	22. 8	10. 5
27. 7	9. 7	5. 8	23. 8	11. 4
29. 7	9. 7	6. 5	22. 4	10. 6
27. 6	9. 7	5. 6	23. 2	11. 7

*All the specimens were obtained in Hokkaidô.

Type locality: Lake Ônuma, Hokkaidô.

Remarks: This is distinguished from *Tribolodon hakuensis hakuensis* by having 35–38 scales before the dorsal fin and 15–16 scales above the lateral line. It is also different from *T. hakuensis hakuensis* in that it has a longer head and snout.

67. Tribolodon taczanowskii (STEINDACHNER).

"Kuki, "Oku-ugui, "Zyusan-ugui"

(Text-figs. 83, a–b)

Leuciscus taczanowskii STEINDACHNER, 1811, Ichth., Beitr., x, p. 16. – JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., vol. 26, p. 848. – TANAKA, 1921, Nihongyogaku, p. 191. – OKADA et IKEDA, 1938, Saitô Hô-on Kai Mus., Research Bull., no. 15, pp. 96-97, text-fig. 5. – UCHIDA, 1939, Fish, Fish. Tyôsen, Bull. Fish Exp. St. Tyôsen, no. 6, pp. 280-299, pl. a7, figs. 1-5.

Richardsonius taczanowskii JORDAN, TANAKA et SNYDER, 1913, Jour. Coll. Sc. Imp. Univ. Tôkyô, vol. 33, art. 1, p. 72.

Acahara jusanensis JORDAN et HUBES 1925, Mem. Carn. Mus., vol. 10, no. 2, p. 180.

Tribolodon jusanensis OKADA et IKEDA, 1937, Zool. Mag., vol. 49, no. 5, pp. 161–171.

Tribolodon taczanowskii OKADA, 1938, Cat. Vert. Jap., p. 145.

The original description* is as follows:

Leuciscus taczanowskii n. sp.

Die hier zu beschreibende Art unterscheidet sich von *L. hakuensis*, der sie sehr nahesteht, hauptsächlich durch die grössere Anzahl der Schuppen längs und under der Seitenlinie. Die Kopflänge ist bei Exemplaren von 20–26 Ctm. Länge 4 mal, die grösste Rumpfhöhe 4 $\frac{1}{5}$ bis mehr als 5 mal in der Korperlänge der Augendiameter nahezu 5-5 $\frac{1}{3}$ mal, die Stirnbreite 3 $\frac{2}{5}$ bis unbedeutend mehr als 3 mal, die Schnauzenlänge ein wenig mehr als 3 mal, die Länge der Pectorale genau oder etwas mehr als 3 $\frac{1}{2}$ mal, die der Ventrale mehr als 1 $\frac{2}{3}$ – 1 $\frac{7}{8}$ mal in der Kopflänge enthalten.

Die stumpt-konische Schnauze überragt nur wenig den vorderen Mundrand. Die Mundwinkel fallen in verticaler Richtung ein wenig vor das Auge. Hinterer Vordeckelrand schwach convex, nach

* Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Classe. Akademie der Wissenschaften. 83 Band. 1 abteilung. 1881. F. STENIDACHNER: Ichthyologische Beiträge (x). pp. 194–195.

vorne und unten geneigt. Vordeckel winkel mehr oder minder bedeutend grösser als ein rechter. Kopf 1½ bis mehr als 1⅔ mal länger als hoch; grösste Kopfqreite mehr als 2 mal in der Kopflänge enthalten. Die beiden unteren Augenrandknochen sind sehr schmal, der hintere längere derselben bildet zum Theile die hintere Umfassung des Auges; das Postorbitale ist rundlich, reicht nach hinten nicht bis zum hinteren Rande des Wordeckls und steht dem Praörbitale an Umfang nach. Der Beginn der Dorsale fällt bei den 3 kleineren der hier beschriebenen Exemplare bedeutend, bei dem 4 grössten, nur wenig hinter der Mitte der Körperlänge. Die grösste Höhe der Dorsale gleicht der Kopflänge mit Ausschluss der Schnautze und its genau oder nahezu 2 mal grösser als die Basislänge der Flosse. DieInsertionsstelle der Ventrale fällt vertical unter den Beginn der Dorsale.

Die Länge der Pectorale ist 1½ – 1⅗ mal in dem Abstande der Pectoralbasis von der Einlekungstelle der Ventralen enthalten. Die Caudale ist am hinteren Rande tief, dreieckig eingebuchtet, bei jungen Exemplaren von circa 20 Cent. Länge nur wenig kürzer als der Kopf, bei alteren circa 1¼ mal in der Kopflänge enthalten.

Die Seitenlinie durchbohrt im Ganzen 81-86 Schuppen, von denen die 3-4 letzten die Basis der Caudale überdecken. Über der Seitenlinie bis zur Basis des ersten obersten Ventral strahles 9–10 (bis zur Bauchlinie 14–15) horizontale Schuppenreihen. Die Schuppen sind festsitzend und zeigen zahlreiche, zarte Radien.

Oberen Korperhälfte stahlbau, Bauchseite gelblich, unterer Theil der Korperseiten gegen die Bauchseite zu siberweiss. D. 10, A. 11–12, V. 10, L. 1, 81-86.

Nach Prof. DYBOWSKI's brieflicher Mittheilung kommt diese Art im japanesischen Meere vor und steigt mur zur Laichzeit in die Flüsse und Süsswasserseen.

Leuciscus taczanowskii ist so nahe verwandt mit *L. hakuenis* GTHR., dass ich anfänglich erstere Art nur als die Jungendform der letzteren hielt. Da jedoch bei *L. taczanowskii* die Zahlder der Schuppen längs der Seitenlinie mit dem Alter zumnimt, und bei jungeren Exemplaren von circa 20 ctm. Lange 81, bei älteren von 26 Ctm. Länge 86 beträgt, wahrend ich bei einem 34½ Ctm. langen Individium von *L. kakuensis* wie Dr. GÜNTHER beiden Exemplaren des britischen Museums nur 73 Schuppen längs der *L. lateralis* vorfinde, so halte ich wenigstens vorläufig eine specifische Trennung für begründet.

Description: Head 4; depth $4\,^2/_3$; D. III, 7; A. III, 8; P. 17; V. 10; scales 93 in the lateral line and 14 between the latter and middle of belly; 17 scales between the origin of the dorsal fin and the lateral line; pharyngeal teeth 5, 2–2, 4; width of head. $2\,^1/_3$ in its length; snout $3\,^1/_3$ in head; eye $5\,^3/_4$ in head; interorbital space a little over 3; pectoral fin $1\,^1/_2$; ventral fin 2.

Body elongate and compressed. Head elongate, pointed, compressed, and the sides flattened; upper profile of head almost straight to tip of snout; snout long, rather blunt and scarcely projecting beyond mandible; eye small, anterior, $1\,^3/_4$ in snout; mouth moderate, maxillary protractile, not reaching posteriorly as far as eye, and not very oblique; lips fleshy, not dilated, without barbels; pharyngeal teeth with grinding surface, slightly hooked; nortrils close together on upper sides of snout, and much nearer anterior edge of eye than tip of the latter; interorbital space and top of the head rather broad and slightly convex. Gill-openings large; gill-rakers short, 4+10; pseudobranchiae present. Anus opens just front of the anal fin. Intestine with a single convolution; peritoneum silvery.

Scales rather small, cycloid, and somewhat even size; no pectoral flap; a small ventral flap.

Origin of dorsal fin nearer base of caudal fin than tip of snout, base of dorsal fin short, the tip somewhat pointed, the first developed ray the highest reaching beyond

others to origin of anal fin when depressed, the base of the fin $1\,^2/_3$ in its height and its margin nearly straight; the anal fin inserted midway between the tip of pectoral and the base of caudal fin, the first developed ray the heighest reaching beyond other fins when depressed, the base of fin $1\,^1/_4$ in its height, and its margin nearlystraight; caudal fin deeply emarginate, the lobes pointed. Pectoral fin reaches about two-thirds the distance to ventral fin; ventral fin inserted slightly before the origin of dorsal fin, and reaches two-third the distance to anal fin. Caudal peduncle long, its least depth $2\,^2/_3$ in head. Lateral line slightly decurved, and continuous.

Color in fresh dark blue on back, silver on the belly; in alcohol dark brown, slightly olivaceous above, the lower surface of body pale or whitish; dorsal, caudal and pectoral fins grayish or brownish black, the other fins pale.

Development: Eggs measured in the specimens from Hokkaidô, 2.5 mm. in diameter and hatch out 11–13 days in 10°C. water temperature. Just hatched larva measured 6.0–6.5 in body length, without chromatophores, is provided with light yellow yolk sac. About 34 to 38 days after, yolk sac is absorved, the larva measured 11 mm. in total length leaves the breeding places. In Hokkaidô, the breeding season begins from the end of June to the beginning of July.

The Juvenile with the body length of 28 mm. shows a nearly adult form, provided with the black pigment line along the demarcations of the lateral muscle layers and with many black chromatophores on the back. The black longitudinal bands run along the mid-lateral line of the body and black pigments appear along the base of dorsal fin. No existance of black pigments on the caudal fin and belly. A longitudinal linear series of several black pigments appear above the base of anal fin.

The young of the body length of 40 mm. has somewhat a projected snout from the upper jaw and has distinct scales on the body.

Rate of growth: According to the observations of the year ring of the scales and the measurements of the rate of growth by the series collection, the body grows 100–130 mm. in lst year and 160–200 mm. in second year. The ascending adult for spawn, measured 400 mm. in total length spends 4 or more years.

Sexual characters: Pearl organs appear on the bodies of both sexes, but somewhat more well-developed on the male than on the female. The male specimens more than 300 mm. body length have the pearl organs on the dorsal side of head, the rays of pectoral fins, ventral fins, and anal fins as well as on the dorsal fin.

The nuptial colors are also more prominent on the male fish than the female.

Habits: The present species are found commonly in cool waters, swimming violently in the middle layer.

In Japan, we found several ecological types, the one is land-locked form living in freshwater area in all life and the others are bay form, estuary form and shallow sea form ascending to rivers at the breeding season. In Korea, the land-locked form is uncertain and most of them ascend rivers in spring to breed and spend the young stage in estuary district before descending to sea.

Table 71. Measurements of *Tribolodon taczanowskii** (STEINDACHNER). (Korean specimens).

SP.No.	Localities	Date Coll.	Sex	Body L.	Num. Dorsal Fin Ray	Num. Anal Fin Ray	Scale	Vert. Numb.
1	River Ryûkoko Kankyô Nandô	III. 1. '30	♀	125mm	III, 7	III, 8	$75\ ^{4}/_{10}$	
2	——	III. 5. '31	♀	127	III, 7	III, 8	$79^{14}/_{11}$	46
3	——	—	♀	133	III, 7	III, 8	$90^{16}/_{13}$	
4	——	—	♂	150	III, 7	III, 8	$84^{14}/_{11}$	48
5	——	—	♂	156	III, 7	III, 8	$84^{14}/_{12}$	
6	——	III. 1. '30	♀	170	III, 7	III, 8	$87^{15}/_{12}$	46
7	——	III. 9. '35	♀	191	III, 8	III, 8	$90^{16}/_{13}$	45
8	——	—	♀	269	III, 7	III, 8	$82^{15}/_{12}$	
9	Ohènri Keishô Nandô	VII. 27. '35	?	151	III, 7	III, 8	$78^{15}/_{11}$	
10	——	—	?	169	III, 7	III, 8	$82^{15}/_{12}$	46
11	Fusan Fish Mark	IX. 5, '36	♀	219	III, 7	III, 8	$85^{15}/_{12}$	47
12	——	IX. 30, '36	♀	228	III, 7	III, 7	$86^{15}/_{11}$	48
13	——	—		234	III, 7	III, 8	$92^{15}/_{12}$	47
14	——	X. 21, '36	♂	286	III, 7	III, 8	$84^{14}/_{11}$	
15	——	III. 2, '34	♂	313	III, 7	III, 8	$87^{15}/_{12}$	
16	——	X. 13, '34	♀	320	III, 7	III, 9	$87^{15}/_{12}$	
17	River Gosen	VI 17-18, '37	♂	117	III, 7	III, 7	$90^{16}/_{12}$	45
18	——	—	♀	160	III, 7	III, 7	$96^{16}/_{13}$	
19	——	—	♀	166	III, 7	III, 7	$93^{17}/_{12}$	47
20	Hanpo Kanhokudo	IV 5, '34	♂	150	III, 7	III, 7	$84^{16}/_{12}$	45

SP.No.	B.L./B.H.	B.L./H.L.	H.L./S.L.	H.L./E.D.	H.L./I.O.	H.L./C.L.	C.L./C.H.	Ph. N.	G. N.
1	4.6	3.7	3.0	4.8	3.2	1.3	1.9		
2	4.9	3.7	3.1	4.7	3.3	1.3	2.0	5, 2-2, 4	5+11=16
3	4.6	3.5	2.9	5.3	3.0	1.3	2.1		
4	4.7	3.6	2.9	5.6	3.2	1.3	2.1	5, 2-2, 4	4+10=14
5	4.8	3.6	3.0	5.7	3.3	1.3	2.0		
6	5.0	3.9	3.1	5.6	3.3	1.2	2.1	5, 2-2, 4	5+12=17
7	4.7	3.8	2.8	6.4	2.9	1.3	2.0	4, 2-1, 4	4+ 9=13
8	4.4	3.9	2.9	6.7	3.0	1.2	2.0		
9	4.1	3.9	3.1	5.6	3.0	1.1	1.9		
10	3.8	4.0	3.0	5.4	2.9	1.2	1.7	4, 2-2, 4	4+11=15
11	4.1	4.1	3.0	6.0	2.8	1.2	1.7	5, 2-2, 4	4+10=14
12	3.9	4.1	3.1	6.3	2.9	1.2	1.7	4, 2-2, 4	4+11=15
13	4.1	4.2	3.1	6.1	2.9	1.2	1.8	4, 2-2, 5	5+11=16
14	4.5	4.1	3.0	6.5	3.0	1.2	1.8		
15	4.3	4.1	3.0	6.8	3.2	1.1	1.8		
16	4.5	4.3	3.0	6.2	3.0	1.1	1.8		
17	3.9	3.4	3.0	5.6	3.1	1.5	1.8		
18	4.2	3.6	2.9	6.1	2.8	1.4	1.8		
19	4.6	3.7	2.9	5.9	2.9	1.3	2.0	5, 1-1, 4	4+10=14
20	4.8	3.8	2.9	6.0	3.0	1.3	1.9	5, 2-2, 4	3+ 9=12

Abbreviations: B.L.=Body length; B.H.=Body Height; H.L.=Head length; S.L.=Snout length; E.D.=Eye diameter; I.O.=Interorbital Space; C.L.=Caudal height; Ph.N.=Pharyngeal teeth number; G.N.=Gill raker number

The present species is omnivorous, taking small animals, mostly insects, eggs and youngs of other fishes, and plant leaves, stems and seeds. This eats also crustaceans, worms and small shells.

In Korea, the breeding is carried out on April. In Hokkaidô, this breeds on the bed of rivers to attach the eggs to pebbles slightly burried under the bottom.

Type locality: Sea of Japan.



Text-figs. 83. a. ***Tribolodon taczanowskii*** (STEINDACHNER). immatured, 28 mm. total length, Mitsugôkô, Korea, after K. UCHIDA.
b. ***Tribolodon taczanowskii*** (STEINDACHNER). matured, 470 mm. total length, Fusan, Korea, after K. UCHIDA.

Distribution: Lake Jusan, Lake Noshiro, Jusaburogata Aomori Pref. (JORDAN & FOWLER); Denkonuma Nishi-Tsugarugun Aomori Pref.; Yasawagimura Hirashika-gun Akita Pref.; Hachirôgata Funakoshi Minami-Akita, Akita Pref.; Tarinoumi-ura Arahama Watari-gun, Miyagi Pref. (OKADA & IKEDA); Lake Zyusan; Lake Denko; Takahoko; Lake Ogahara, Aomori Pref.; Lake Hachirû; River Ômonn Akita Pref.; River Mogami, Ôishida Iwate Pref.; Matsushima Bay, Miyagi Pref.; (IKEDA); Hokkaidô, Honshû, Korea (OKADA); Freshwaters of Japan (JORDAN, TANAKA & SNYDER).

Remarks: In the present species, JORDAN and HUBBS, (1925) recognized two species, *Acahara jusanensis* JORDAN et HUBBS, and *Leuciscus taczanowskii* STEINDACHNER proper. BERG (1909) accepted the present species as being identical with *Leuciscus brandti* (DYBOWSKI). But, according to FOWLER's descriptions (1924) and our statistical observations (1936, 1937), it seems desirable that the present species includes *A. jusanensis* JORDAN and HUBBS. Judging from our observations, the present species seems to migrate from the northern part of the sea of Japan to this district.

In *L. taczanowski* ST. recorded by D. S. JORDAN and H. W. FOWLER in 1903, D. S. JORDAN and C. L. HUBBS (1925) recognized two species, one with about 80 scales on the lateral line, the former represents *Acahara jusanensis* JORDAN et HUBBS and the latter

L. taczanowskii proper. But according to the following table given here, in the Japanese examples with 77 to 98 scales on the lateral line such two and are not forms distinguishable from each other.

Table 72.* The variation of the scales in the lateral line of *T. taczanowskii* (STEINDACHNER) of Japan and Korea.

Localities	Scales in lateral line																					
	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98
Hokkaidô																						
Lake Abashiri					1		1	2	2				1				1					
Lake Mokoto			2	2	1		4	2	1													
Lake Tobutsu									1	1		1		1								
Lake Jusan Honshû					4	2	4	3	5	6	2	13	8	7	7	5	4	2	2	3	1	1
Lake Denko							1															
Lake Hachirô							1															
River Omono	1	1		1																		
River Mogami										1												
Lake Ogahara	2	2	4	4	5	6	10	4	6	4	2	2	1									
Lake Takahoko				1																		
Bay Matsushima										1												
Korea Gensan									3	1												
Kogendô									3	1												
Seishin														1				4				

* IKEDA, H., 1938: Sc. Rep. Tôkyô Bun Daig., Sect. B. No. 56, pp. 163–192.

Furthermore, basing upon the H. W. FOWLER's description in 1924 and IKEDA's measurements above, *T. taczanowskii* (ST.) distinguished from *L. brandti* (DY.) by having fewer scales anterior to the dorsal fin and no black blotch at the base of the caudal fin.

Genus **Moroco** JORDAN et HUBBS, 1925.

Type – **Pseudaspius bergi** JORDAN et METZ.
Moroco, JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 180–181.
Phoxinus, AGASSIZ, 1835, Mem. Soc. Sci. Nat. Neufchatel, p. 37.
Hemitremia, COPE, 1870, Proc. Amer. Phil. Soc., p. 462.
Iotrichthys, JORDAN et EVERMANN, 1898, Fish. N. M. Amer., p. 243.

Characters: Body elongated compressed. the antero-dorsal and postero-ventral outlines being subhorizontal and parallel; head subconical; snout pointed, somewhat overhanging the upper lip; lower jaw included, with its lip rather thin, with a broad frenum; upper jaw somewhat thick, without barbels; gill-rakers more or less rudimentary, only 3 to 6 on lower limb; pharyngeal teeth biserial, with four or five teeth in the outer row, and two in the inner row; dorsal fin posteriorly located, its origin being behind the end of the base of the ventral fin origin of anal fin under last ray; dorsal and anal fins each with seven branched ray; scales small or minute; individual scales oval in outline; the radii strongly developed on all fields of scale; the circuli continuous, well-spaced and parallel with the margin of the scale. Lateral line complete, running along the midlateral line of the caudal peduncle, somewhat curved downward on the trunk. Intestine short; peritoneum blackish brown. Most, sometimes only a few of the scales on the lateral sides of body show dark brown on the posterior part of the scales. Nuptial males with the upper parts of the head and body covered with minute pearl organs.

Ket to the Japanese species of Moroco

a[1]. Caudal peduncle excessively deep in the adult, its least depth nearly 2⁄8 length of head. Scales in lateral line to caudal base fewer than 70. .... **M. percnurus percnurus**

a[2]. Caudal peduncle moderately deep in the adult, its least depth about half the length of the head. Dark scales more conspicuous than the lateral stripe. Scales in the lateral line 70 to 80. Eye in adult only half length of snout. .... **M. steindachneri**

b[1]. Caudal peduncle very deep in the adult, its least depth about two thirds length of head. Dark lateral stripe more line 68. .... **M. jouyi**

68. Moroco steindachneri (Sauvage).

Fat chub, Fat minnow, Mud minnow,
"Aburamutsu, Abura-haya, Dorobae"
(Text-figs. 84, a–b)

Phoxinus steindachneri Sauvage, 1833, Bull. Spc. Philom., Paris, p. 5. – Jordan et Fowler, 1903, Proc. U. S. Nat. Mus., vol. 26, p. 850. – Okada, 1938, Cat. Vert. Japan, p. 145. – Okada et Ikeda, 1938, Saitô Hô-on Kai Mus., Research Bull., no. 15, pp. 97–99, text-fig. 6. – Okada, Matsubara et Uchida, 1935, Nihongyorui Zusetsu, p. 87, pl. 32, fig. 1. – Tanaka, 1921, Nihon Gyogaku, p. 192.

Hemitremia steindachneri Jordan, Tanaka et Snyder, 1913, Jour. Coll. Sc., vol. 33, art. 1, p. 71.

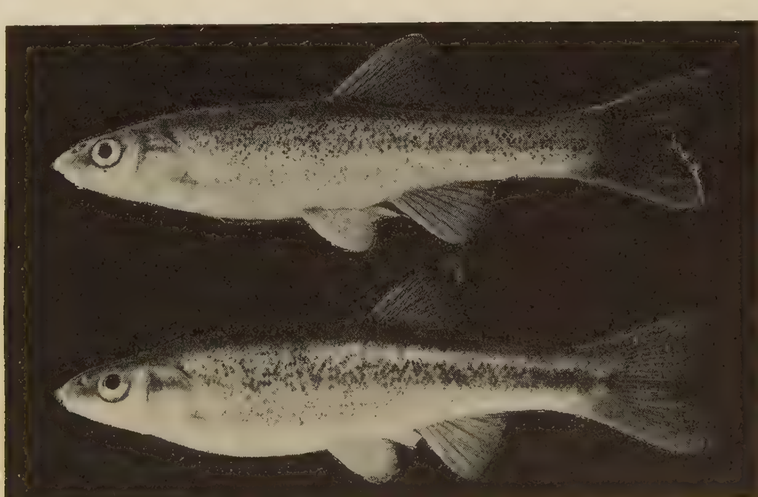
Leuciscus steindachneri Jordan et Snyder, 1901, Prel. Check List Fish. Japan, p. 48. - Mori, 1936, Stud. Geogr. Dist. Freshwater Fishes East Asia, p. 12.

Leuciscus dorobae Ishikawa, Proc. Dept. Nat. Hist., Tokyô, Imp. Univ., I, p. 6, pl. 3, fig. 2.

Pseudapius atrilatus Jordan et Thompson, 1914, Mem. Carn. Mus., vol. 6, no. 4 pp. 231–232, pl. 26, fig. 3.

Moroco steindachneri Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 181–182.

Moroco yamamotis Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 182–183.



Text-figs. 84,–a. ***Moroco steindachneri*** (Sauvage). ♂ ×1
b. ***Moroco steindachneri*** (Sauvage). ♀ ×1

The original description* is as follows:

Phoxinus steindachneri SAUVAGE 1883

D. 9; A. 9; L. lat. 80.

Hauteur du corps six fois deux tiers, longueur de la tête cinq fois un tiers dans la longueur totale. Museau plus long que l'oeil dont le diamètre est compris quatre fois un tiers dans la longueur de la tête; espace interorbitaire plus large que le diametre de l'oeil. Dorsale commencant à égale distance du pédicule de la caudale et du centre de l'oeil; caudale échancre, Jaunâtre, avec de nombreux points et des taches nuageuses noiratres; une large bande noire allant de l'oeil à la caudale; dorsale et caudale rembrunies; dessus de la tête et extremite du museau noir Longueur, 0,170.

Nom vulgaire: Aboura motzou.

Description: Head 4 in length to the base of caudal; width of head 1.9 in its length; depth of body 5 in its length; eye 5 in head; snout 3.66; interorbital space 3.375; maxillae 3.375; caudal peduncle, depth 2.25, length 1.125; first dorsal ray, length 1.4; base 2.5; first anal ray, length 1.66, its base 2.5; pectoral 1.5; ventral 1.8.

Body elongated, not greatly compressed; snout slightly projecting longer than eye; interorbital space greater than eye, lower jaw included; upper profile of head straight from nostrils to occiput; posterior margin of the eye midway between snout and edge of opercle; maxillae not reaching eye; pharyngeal teeth hooked, with very narrow grinding surface or none; gill-rakers small, widely set; intestine short, one convolution; peritoneum dark.

Dorsal fin very slightly nearer base of the caudal fin than tip of the snout, its margin straight; and inserted under the last dorsal ray; pectoral fins extending over half-way to the ventral fins; latter reaching vent, not reaching the anal fin. Caudal fin emarginate. Scales small, especially on occiput and breast; lateral line slightly decurved, continuous.

Secondary sexual characters: The pectoral and ventral fins of male are stronger and much longer than those of female, extending far posterior than the anus. The urinogenital papillae of the male is larger and longer than that of the female. The minute pearl organs appear on both sexes. In male, they exist on the snout, internasal space, interorbital space, the top of head, opercle, infraopercle, preopercle, interopercle, anterior orbit and fin rays, while in female, indistinct pearl organs appear on snout, interorbital space and on head.

Color dark above, with fine irregular stippling; a darker band arising on the snout and terminating with a slight dilation at the base of the caudal fin, which has a basal spot in young specimens; breadth of band equal to diameter of eye; dark median band from occiput to caudal. Upper fins slightly dusky, lower clear. Caudal fin yellowish, with numerous clouded black spots. Top of the head and tip of the snout black.

Type locality: Lake Biwa.

Habits: The breeding habit is not yet researched in details. The fish are found every-

* Bulletin de la Société Philomathique de Paris, Septième Série, Tome Septième, pp. 148–149.

Table 73. Measurements of *Moroco steindachneri* (SAUVAGE).

Collection	Fish. Mie Univ.*			
Total length	70.3mm.	65.0mm.	63.0mm.	59.5mm.
Body length	58.0	52.3	51.0	48.2
Body length/Head	3.74	3.58	3.78	3.63
Body length/Depth	5.13	4.85	5.05	5.36
Body length/Predorsal length	1.84	1.80	1.82	1.86
Body length/Prepectoral length	3.92	3.68	3.92	3.77
Body length/Preventral length	2.07	1.96	2.04	1.93
Body length/Preanal length	1.59	1.54	1.59	1.46
Head/Snout Head/Upper jaw	3.23	3.84	3.86	3.50
Head/Upper jaw	3.23	3.65	4.00	4.43
Head/Interorbital width	2.67	2.52	2.60	2.96
Head/Diameter of Eye	3.88	3.84	3.38	3.33
Head/Length of Caudal peduncle	1.05	1.11	1.20	1.21
Head/Depth of Caudal peduncle	2.46	2.56	2.70	2.96
Head/Length of Dorsal fin	2.82	2.75	2.25	2.77
Head/Length of Anal fin	2.58	2.52	2.02	2.77
Head/Height of Dorsal fin	1.28	1.25	1.25	1.36
Head/Height of Anal fin	1.55	1.57	1.54	1.78
Head/Pectoral length	1.55	1.49	1.73	1.55
Head/Ventral length	1.87	1.87	1.77	1.90
Date	27, V, 1955			
Locality	Lake Biwa, Shiga Prefecture			

* Faculty of Fisheries, Prefectural University of Mie.

where in rivers, ponds and swamps but look like to live in clear currents. This is one of the cyprinoid fishes which are distributed in the uppermost rivers of Japan. According to D. MIYADI, it is found in the water source of the River Aga, situated 1665 m. above the sea level, under the water temperature of 11.9°C. The food is consisting of aquatic insects, crustaceans, worms, diatomes and organic matters.

Distribution: The present species distributed in cool mountain regions of Japan excepting with Hokkaidô. The present species is distributed far south of Aomori Prefecture, Honshû, Shikoku and Kyushû. The northern limit may be the River Kitakami, Iwate Prefecture (OKADA, AOYAGI). Miyazaki Prefecture (AOYAGI); Kagoshima Prefecture (OGAWA). Lake Biwa (JORDAN, TANAKA & SNYDER); Lake Biwa (JORDAN & SNYDER); Honshû, Shikokû, Kyushû (OKADA); Kumamoto, Hamada (WAKIYA); Toyama (YOSHIZAWA); River, Kinano Kishû (KUROIWA); Kamishibi, Fukui, Nagano (NAKANO); Yamanashi (IMP. MUSEUM); River, Dobuchi Nakatsugaru-gun, Aomori Pref.; Yawawagi, Hirashika-gun, Akita Pref.; Orikabe Higashi, Iwai-gun, Zyanoshima Morioka, Iwate Pref.; Kawatari, Tamatsukuri-gun, Miyagi Pref.; Tazima Minami, Aizu-gun, Kitakatayama-gun, Fukushima Pref., (OKADA & IKEDA); Nagasaki Pref.; Shiga Pref; Oita Pref.; Yamagata Pref.; Okayama Pref.; Gifu Pref.; Kyôto; Wakayama Pref.; Tochigi; Pref., Nara Pref.; (ÔKADA, MATSUBARA, UCHIDA); Lake Yamanaka, Shizuoka Pref. (JORDAN & HUBBS).

Remarks: JORDAN and HUBBS remarked that the present species is extremely close to *Moroco jouyi* which appears to be a local form confined to the inland of Tsushima,

Table 74. Measurements of *Moroco steindachneri* (STEINDACHNER).

Reg. No.*	Standard Length	Depth of Body in Length	Head in Length	Snout in Height	Eye in Height	Depth of Caudal peduncle in Height	Scales in Lateral Line
277mm.	76. 7mm.	4. 8mm.	3. 6mm.	2. 9mm.	4. 3mm.	2. 5mm.	75mm.
5105	88. 3	4. 9	3. 8	2. 8	4. 3	2. 3	76
——	76. 9	4. 5	3. 6	2. 9	4. 5	2. 3	76
——	77. 2	4. 3	3. 4	2. 9	4. 6	2. 5	69
——	92. 7	4. 7	3. 6	2. 8	4. 5	2. 2	75
——	96. 5	5. 1	3. 8	2. 6	4. 9	2. 4	75
10031	91. 6	4. 2	3. 9	2. 7	4. 1	2. 2	73
11874	76. 2	?	4. 0	2. 9	3. 9	2. 1	?
17924	89. 3	4. 6	3. 6	3. 0	4. 9	2. 2	69
26099	69. 0	4. 2	3. 4	2. 9	4. 2	2. 9	67
26606	88. 8	3. 9	3. 4	2. 6	5. 0	2. 5	76
——	91. 3	4. 2	3. 4	2. 7	5. 0	2. 6	74
——	93. 8	4. 2	3. 6	2. 7	5. 0	2. 5	77
26625	84. 0	4. 5	3. 5	3. 3	4. 8	2. 4	73

*Reg. No. indicates the registered number of specimens preserved in Saito Hô-on Kai Museum, Sendai, Japan.

and differing from both the Japanese *M. steindachneri* and the Korean species of *M. bergi*. Nuptial males have the upper parts of the head and body covered with minute pearl organs.

JORDAN and THOMPSON stated that *Pseudaspius atrilatus* may be readily separated from Japanese species of *Leuciscus* by the insertion of the anal fin, which lies under the last ray of the dorsal, and by the small scales. But from their original descriptions and figure (PL. 26, FIG. 3), that species is clearly identified with the present *Moroco steindachneri*.

S. H. TANAKA (1931) united all the species of *Leuciscus* known from Japan into one species *Leuciscus steindachneri* (SAUVAGE). Considering the specimens preserved in the Saito Hô-ôn Kai Museum, this species seems to be related to *Phoximus yamamotis* (JORDAN & HUBBS) found in Lake Yamanaka, Yamanashi Prefecture and *Phoximus lagowskii* (DYBOWSKI) in Siberia.

Habits: They are living in shallow waters of lakes and swamps or in stagnant waters of mountain rivers. Omnivorous. Breeding season continued from March to July, somewhat changeable by the water temperature. The female spawns the eggs under the sand by pushing her head into it and the many males fertilized them running after the female.

69. **Moroco jouyi** (JORDAN et SNYDER).

"Takahaya"

(Text-fig. 85)

Leuciscus jouyi, 1900 JORDAN et SNYDER, 1900, Proc. Nat. Mus,, vol. 23, no. 1235, pp. 741-742, pl. xxxi. – JORDAN et FOWLER, 1903, Proc. Nat. Mus., vol. 26, no. 1334, p. 849. – TANAKA, 1921, Nihon Gyogaku, p. 192.



Text-fig. 85. ***Moroco jouyi*** (JORDAN et SNYDER).

The original description is as follows:

Leuciscus jouyi JORDAN et SNYDER, new species* No. 45228, U. S. N. M. Sasuma, island of Tsushima 1885, twelve specimens.

Head 4 in length, depth 3½, depth of caudal peduncle 6⅔, eye 4½ in head, snout 3, interorbital 2½, D. 8, A. 8, P. 16; scales in lateral line 68, above lateral line 18; between insertion of dorsal and occiput 41. Teeth 2.5-4.2.

Body deep and compressed, the caudal peduncle notably so. Head very small, pointed, depressed; the width equal to the depth. Interorbital space wide, low, somewhat convex.

Eye large; nearer to tip of snout than to edge of opercle, a distance equal to its diameter. Snout sharp, the jaws equal in length. Mouth small, oblique; lips thin, maxillary reaching a vertical through posterior edge of orbit. Gill-rakers on first arch 2+6; short, pointed, and far apart. Pharyngeal teeth in two rows; 5-2 on the left side, 4-2 on the right. Those of the major row high, compressed sidewise; the one nearer the longer straight limb of the arch somewhat rounded and short; one or two teeth on each side slightly hooked; grinding surface present, though not very broad. Teeth of secondary row slender, easily displaced; one on each side showing traces of a grinding surface. Peritoneum silvery. Air-bladder large, with one constriction; alimentary canal short, without convolutions.

Head naked, without barbels or other distinctive dermal characters. Body with scales of medium size. Lateral line complete, not extending on caudal fin; the anterior part bending downward parallel with the ventral contour; posterior part of lateral line in middle of caudal peduncle.

Dorsal inserted midway between center of eye and base of caudal fin; the first ray very short, simple, and closely adnate to the second; third ray longest. Anal inserted a little posterior to base of dorsal, its base short, first simple ray similar to that of dorsal; third ray longest; tips of rays when fin is depressed falling far short of base of caudal. Pectoral fins rather pointed. Ventrals rounded, reaching anal opening.

Body a little darker above than below; a faintly defined, narrow, lighter band along the sides, not visible anterior to the dorsal fin.

One of the cotypes (NO. 6,376, Leland Standford Jr. University Collection) has three teeth on one side in the lesser row.

Description: Head, 4; depth, $3^2/_3$; D. III, 8; A. III, 7: P., 16: V., 9; scales, 68 in the lateral line; about 18 scales between origin of dorsal and lateral line, and about 16 between the latter and middle of belly; pharyngeal teeth, 2, 5-4, 2; width of head,

* JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. 23, no. 1235, pp. 741-742.

about $1\,^7/_8$ in its length; snout, $3\,^2/_3$ in head; eyes, a little over 4; interorbital space, $2\,^1/_2$; pectoral, nearly $1\,^1/_2$; ventral, $1\,^2/_3$.

Body elongate, rather deep, and compressed. Head small, pointed, depressed, and its width equal to its depth; snout pointed, rounded, and slightly oblique, the maxillary protractile, and reaching posteriorly to anterior edge of eye; lips somewhat fleshy, not dilated; several pharyngeal teeth of outer row with narrow grinding surface, and others slightly curved; nostrils close together on sides of snout, nearer front of eye than tip of snout; interorbital space and top of head broad and slightly convex. Gill-opennings large; gill-rakers short and pointed, 2 + 6; pseudobranchiae present. Intestine short. Peritoneum silvery.

Scales large, cycloid, and of rather even size; no pectoral or ventral flap.

Origin of dorsal much nearer the base of caudal than tip of snout, and when depressed it reaches within a short distance of base of the last anal ray; origin of anal about midway between tip of pectoral and base of caudal; caudal broad and deep, emarginate and lobes rounded; pectoral about three-fifths to ventral; ventral inserted well before dorsal. and much nearer the tip of pectoral than origin of anal. Caudal peduncle very deep and compressed, the least depth about equal to depth of head. Lateral line slightly decurved and continuous.

Color in alcohol brown, a little darker above and somewhat paler beneath, the sides mottled with scales darker than the others. A dark median band runs along the back

Type Locality – Sasuma, island of Tsushima.

Table 75. Measurements of *Moroco jouyi* (JORDAN et SNYDER).

	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Length of body	129	106	95	89	81	66	61	53
Depth of body expressed in hundredths of length	27	28	27	27	26	22	23	24
Depth of caudal peduncle	14	14	155	16	15	14	13	14
Length of head	26	25	25	265	26	26	26	26
Depth of head at occiput	15	145	15	15	14	145	16	17
Width of interorbital space	10	95	9	9	85	8	9	9
Length of snout	85	8	8	85	85	8	8	8
Diameter of orbit	5	5	6	6	6	7	6	7
Distance from snout to dorsal fin	56	55	555	58	58	55	58	56
Height of longest dorsal rays	18	18	20	20	185	19	18	19
Distance from snout to anal fin	67	68	67	69	69	66	68	67
Height of longest anal rays	15	14	17	17	15	15	15	15
Distance from snout to caudal fin	25	23	26	25	245	22	25	25
Length of caudal fin	25	265	27	255	25	25	—	27
Distance from snout to ventral fin	52	54	51	47	54	52	50	54
Length of ventral fin	14	135	15	16	145	14	13	14
Length of pectoral fin	17	16	18	18	18	16	17	18
Number of rays in dorsal fin	8	8	8	8	8	8	8	8
Number of rays in anal fin	8	8	8	8	7	7	8	8
Number of rays in pectoral fin	16	16	16	16	15	15	16	16
Number of scales before insertion of dorsal fin	41	38	37	42	45	43	—	40
Number of scales in lateral line	68	65	63	68	69	64	72	68
Number of scales above lateral line	18	16	18	17	19	19	18	19

from the occiput to dorsal and then continues behind the fin to caudal. Sometimes the body is more or less finely mottled with brown.

Distribution: Sasuma, island of Tsushima (JORDAN & SNYDER); River Kaminutani near Lake Biwa (JORDAN & FOWLER).

Remarks: JORDAN et SNYDER* remarked that the collector did not note whether the present species was found in salt or fresh water, since the island of Tsushima is said to contain only 262 square miles, about one-third of which is cut off from the larger part by a narrow channel.

70. Moroco percnurus percnurus (PALLAS).

"Yachiugui, Darumahaya"

(Text-fig. 86)

Cyprinus percnurus PALLAS, Zoogr. Ross. - As., III, p. 312. - GÜNTHER, 1868, Cat. Fish. Brit. Mus., vol. 7, pp. 265-266.

Phoxinus percnurus percnurus, TARANETZ, 1937, Bull. Pac. Sci. Inst. Fish & Ocean, Tom. 11, vol. 11, p. 75.

Moroco percnurus UCHIDA, 1939, Bull. Fish. Exp. St., no. 6, pp. 304-306, pl. 29, fig. 5. - OKADA et NAKAMURA, 1950, Nihon no Tansui Gyorui, p. 171, fig. 95.



Text-fig. 86. ***Moroco percnurus percnurus*** (PALLAS).

Description: Total length 118.8 mm. to 88.3 mm. length exclusive of caudal fin 99.7 mm. to 73.2 mm.. Depth 4.8 to 3.6 in length, at the origin of dorsal fin; head 3.7 to 3.4. Eye 4.4 to 3.5 in head; snout 3.8 to 3.1; interorbital space 3.2 to 2.9; depth of caudal peduncle 2.8 + 2.6. Length of caudal peduncle 5.1 to 4.3; predorsal 1.9 to 1.7. D. 10 + 1; A. 10 + 1 to 9 + 1. Scales in lateral line 76 to 70; above 18 to 16; below 11 to 10, predorsal 44 to 35. Gill-rakers 11 to 9. Pharyngeal teeth 4.2–5.2.

Body somewhat elongate, slightly compressed, head also compressd, snout rounded, somewhat short, nearly equal to the anterior end of upper jaw. Eye large, situated somewhat anteriorly on the head. Nostril somewhat closed together, separated by small

* JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. xxiii, no. 1235, p. 742.

septum, opened nearer the anterior margin of orbit than the tip of snout.

Mouth obliquely opened on the snout, the upper jaw somewhat broad, horse-shoe shaped from the ventral, the lower jaw somewhat shorter than upper jaw, the posterior end of upper jaw slightly beyond the posterior margin of nostril not reaching to the anterior margin of orbit, the lips smooth, without barbels. Gill opening broad, opening on lateral side. Gill rakers big, short, few in number, pseudobranchiae very small. Pharyngeal teeth in two rows. Intestine shows one convolution, as long as the body excepting with the caudal fin, vent opens just front of anal fin, peritoneum light brown, somewhat darker on dorsal. Scales small, cyloid, arranged in the scales on the lateral side of body, just on the insertion of dorsal fin exhibit elongate shape have indistinct year rings. Dorsal fin short, situated somewhat posteriorly, the distance between the insertion of dorsal fin and the snout nearly equal to that of the insertion of dorsal fin and the base of emargination of caudal fin; outer margin somewhat rounded, upper posterior margin somewhat, curved, the lst branched ray somewhat longer than twice of the last fin ray; the lst unbranched ray very short, hinding under skin; the 2nd about some what shorter, $^1/_2$ long of the thirdr ays; the third unbranched ray not reached to the tip of fin; the tips of the lst and second rays of fin the highest; the posterior rays gradually shorter to final ray. Caudal fin shallowly emarginate, the upper and lower lobes round. Anal fin nearly same to dorsal fin features; the anterior fin ray somewhat shorter than dorsal fin; all the rays somewhat shorter than of those of dorsal fin. Anal fin inserted on the posterior margin of dorsal fin. The insertion of ventral fin situated anteriorly in the distance of eye diameter from the anterior margin of dorsal fin insertion. The posterior margin of ventral fin not reached to vent. Pectoral fin somewhat narrower in breadth. Caudal peduncle compressed, somewhat long. Lateral line complete, running straight on the midway of caudal peduncle; broadly curved anteriorly.

Color in fresh; on the ground color dark yellowish brown and dark brown on the back, lighter on the belly; light dark brownish broad longitudinal band along the midway of the trunk; the anterior end indistinct; narrow lighter part on the back of the band; dorsal dark brown median longitudinal band running along the mid-dorsal line of the body to the end of caudal peduncle. Dark brown small spots irregularly distributed on the lateral sides of body, characterizing the peculiar patterns of *Moroco* group.

Two elongate black spots situated on the base of caudal fin, extending transeversely, somewhat posteriorly from the posterior end of the dark brown longitudinal band. Ventral fin light color and the others light dark.

Secondary sexual characters: In the male, the pectoral fin is longer than that of the female; the posterior end is extending far posteriorly, $^2/_3$ of the anterior part of the base of pectoral fin and the origin of ventral fin, while in the female, the posterior end of the pectoral fin is somewhat beyond $^1/_2$ of anterior part.

Color and pattern in formalin generally dusky brown, belly paler, being speckled irregularly with dusky; a dusky band runs from the base of caudal fin to scapula, being indistinct at scapula; a faint blotch at the base of caudal fin, situated at the origin of

the above-mentioned lateral band; the back medianly with a longitudinal black streak. Dorsal and caudal fins dusky.

Habits: The present species distributed in Hokkaidô. They are commonly found in ponds and swamps of cool regions, the plain where water plants are densely planted and the waters contain arganic mathers. They feed on small insects and crustaceans.

Distribution: The present species is distributed far north from Siberia and the Ural district to Northern Manchuria and North Korea, away to Saghalien. Lake Akan; Lake Panke, Lake Abashiri (Okada, Aoyagi); River Teshio (Soeda).

Remarks: The present species belongs to the northern form of the genus *Moroco*, distributed Siberia, Maritime, and Saghalien. D. Miyadi (1933) gave the specific name of *Phoxinus percnurus sachgalinensis* Berg to "Yachi Ugui" of Sakhalin, but the author does not agree with his identification.

Genus Zacco Jordan et Evermann, 1903.

Type: **Leuciscus platypus** Schlegel

Characters: Body moderately elongate and compressed; head compressed; snout conical, pointed; eyes moderate; mouth oblique; not notched; no barbels; teeth 5 or 4, 4, and 2 or 1-1, or 2, 4 and 4 or 5; interorbital space convex. Intestine short. Peritoneum black. Scales cycloid, narrowly imbricated, and 40 to 60 in the lateral line. Dorsal fin nearer tip of snout than base of caudal fin, or midway between them; developed rays 7; its base long, and compresed of 9 or 10 developed rays; caudal emarginate; pectorals sometimes reaching ventrals; ventrals inserted a little before or below the origin of dorsal. Lateral line continuous and decurved. Breeding males have the head, the lower surface of the caudal peduncle, and the anal fin spotted with horny tubercles, not as numerous as those in *Opsariichthys*, and larger in proportion. The anal fin also has the developed rays elongated and with adipose expansions. This species is distributed widely in Japan, Korea, Southern Manchuria, and China.

Key to the Japanese species of Zacco

a[1] Scales about 43; teeth in inner row 2-2; sides with broad, dark cross bars .... **Z. platypus**

a[2] Scales about 52; teeth in inner row mostly 1-1; a dark lateral band mostly distinct behind .... **Z. temmincki**

71. Zacco platypus (Temminck et Schlegel).

"Oikawa, Haya"

(PL. XXXIV, figs. 1-6)

Leuciscus platypus Temminck et Schlegel, 1846, Fauna. Japon. Poisson, pp. 207-209, pl. 101, fig. 3. - Richardson, 1846, Rept. Brit. Assoc. Adv. Sci., p. 300.

Opsariichthys platypus Günther, 1868, Cat. Fish. Brit. Mus., vii, p. 296 – Sauvage, 1882; Bull. Soc. Philom., p. 8. – Ishikawa, 1895, Zool. Mag., p. 121 – Ishikawa, 1897; Prel. Cat., p. 11.

Barilius platypus Bleeker, 1897, Verh. Akad. Amsterdam, xviii, p. 23 – Jordan et Snyder, 1901, Annot. Zool. Jap., iii, p. 47 – Regan, 1908, Proc. Zool. Soc. London, p. 59.

Zacco platypus Jordan et Fowler, 1903, Proc. U. S. Nat. Mus., xxvi, pp. 851-852. – Smith et Pope, 1906, Proc. U. S. Nat. Mus., xxxi, p. 462 – Tanaka, 1908, Zool. Mag. no. 237, p. 235. – Tanaka, 1908, Annot. Zool. Jap., vii, p. 7. – Tanaka, 1909, Ibid., vii, p. 133. – Cockereli 1911; Zool Anz., xxxviii, p. 85. – Tanaka, 1911, Fig. Desc. Fishes Jap., iv, pl. 200, figs. 72-74. – Tanaka, Ibid., v. p. 83. – Snyder, 1912, Proc. U. S. Nat. Mus., xlii, p. 104. – Jordan, Tanaka et Snyder, 1913, Jour. Coll. Sci., Tôkyô, xxxiii, p. 75. – Jordan et Thompson 1914, Mem. Carn. Mus., vi, no. 4, p. 232. – Ôshima, 1919, Mem. Carn. Mus., x, p. 237. – Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 184-185. – Tanaka, 1921, Nihon Gyogaku, p. 193. – Miyadi, 19. Kyôtofu no Tansuigyo p. 32, pl. 4, figs; 29-29a. – Ebina 1931, Nihon Zyûyô gyorui Zushû, pl. 35. – Chu, 1931, Biol. Bull. St. John's Univ., no. 1, p. 29. – Kimura, 1934, Journ. Shang. Soc. iii, vol. 1, pp. 41-44. – Okada, Matsubara et Uchida, 1935, Nihon Gyorui Zusetsu, p. 86, pl. 31, fig. 3. – Mori, 1936, Stud. Geogr. Dist. Fresh Water Fishes East Asia, pp. 12, 17, 25, 32, 42. – Uchida, 1939, Bull Fish. Exp. Stat. Tyôsen, no. 6, pp. 331-339, pl. 33, figs. 1-7, text-figs. 38, 1-4. – Okada et Matsubara, 1938, Keys to Fish and Fish-like Anim. Jap., p. 76. – Okada et Nakamura, 1948, Freshwater Fishes of Japan, pp. 171-172, fig. 96. – Kamohara, 1950, Desc. Fish. Prov. Tosa and Kishû, Japan, p. 45, fig. 40.

Leuciscus macropus Schlegel, 1840, Faun. Japon. Poisson, p. 209. pl. 101. fig. 2.

Barilius macropus Bleeker, 1879, Verh. Akad. Amsterdam, xviii, p. 23.

Barilius minor Bleeker, 1867, Verh. Akad. Amsterdam, (2), iii, p. 248 – Bleeker, 1879. Ibid., p. 23.

Leuciscus minor Schlegel, 1840, Faun. Japon. Poisson, p. 210, pl. 101. fig. 3.

The original description* is as follow:

Leuciscus platypus

Pl. CI, fig. 1.

C'est de toutes les especes japonaises celle qui offre l'anale la plus allongée, et qui se reconnait eu outre facilement, parce que les rayons dont cette nageoire est composée, sont en grande partie applatis et indivisés. Nous abons sous les yeux une huitaine d'individus de cette espéce, conservés, à l'exception d'un seul, dans la liqueur forte; la taille de ces individus varie de quatre á six pouces.

Le corps de cette espéce est allongé et comprimé; sa grosseur est deux fois et demiedans la hauteur du corps, laquelle entre environ quatre fois et un tiers dans la longueur comprise entre l'extrémité du museau et l'échancrure de la caudale. La longueur de la tête est un peu moins considérable que la hauteur du tronc. Le museau occupe un peu plus du tiers et les yeux un peu plus du cinquiéme de la longueur de la tête; l'éntre-deux des yeux, enfin, egale la longueur du museau. La ligne transversale que sépare la tête de la nuque forme au milieu une saillie arrondie et trés-peu sensible. Le dessus de la tête est assez arrondi vers les côtés. Le museau se rétrécit sensiblement en avant des narines, pour finir vers le devant en une pointe assez courte, conique, mais arrondie. Les narines s'ouvrent sur les côtés de la face supérieure du museau, un peu plus prés des yeux que de l'extrémité du museau; elles sont comme a l'ordinaire doubles, et l'orifice postéieur n'est qu'une fente en croissant et susceptible d'être fermée au moyen de la cloison qui sépare les deux orifices dont nous parlons. Le maxillaaire s'étend en arriere presque jusque sous, laplomb du bord antérieur de l'orbite. La fente de la bouche forme avec l'axe longitudinal du poisson un angle d'environ vingt degrés. L'intermaxillaire s'étend jusque sous le bord antéricur du museau; la mâchoire inférieure, conique par devant, est tant soit peu plus courte que la supérieure; les lévres sont peu charnues. Le sous-orbitaire antérieur est de forme deltoide, et touche avec le bord arrondi de sa partie large à la mâchoire supérieure; les autres sousorbitaires forment une bande continue, que est du doble plus large derriére l'aeil que sous cet

*Temminck et Schlegel, 1846, Fauna Japonica, Poisson, p. 207-209.

organe, oú sa largeur n'égale que le tiers du diamètre des yeux. Le préopercule forme un angle droit et un peu arrondi, le bord de l'opercule est assez arqué. La tête est revetue de tous cotes d'un peau une et dont la surface est tres-unie, mais qui offre, à l'époque du frai, sur certaines parties des enfoncements ou de petites fosses circulaires peu profondes et distribuées sur des rangées longitudinales: on en voit une rangée sur le bas du préopercule, une autre sur le bas du premier sous-orbitaire; une autre encore s'etend le long des bords inférieurs de la mâchoire, inférieure; il en existe une au dessus l'aeil; celle enfin qui garnit les côtés du museau et les sousorbitaires, est assez longue et se prolonge souvent sur l'opercule qui quelquefois se trouve en outre pourvu de petits enfoncements semblables, mais peu nombreux et irrégulièrement dispersés par-ci par-là. La ligne latérale est simple et occupe le commencement du tiers inférieur du corps; parvenue vis-à-vis des ventrales, elle commence à monter pour se diriger sir le bord de la fente des ouies, où elle finit sur la ligne du diamètre horizontal de l'aeil. Les écailles sont de grandeur moyenne, mais plus grandes sur les flancs que sur les autres parties du poisson; celles de la poitrine et du ventre sont très-petites; les stries divergentes de la surface des écailles sont inégales, peu serrées et beucouq moins apparentes que les couches concentriques; elles sont parsemées de petits points noirs imperceptibles à l'aeil nu; le bord de leur partie libre formant un angle, les lignes obliques qui indiquent les rangées d'écailles sont continues et non pas interrompues, comme cela a lieu dans la plupart des poissons. On compte 44 écailles sur la ligne latérale, et 15 rangées entre le dos et le ventre, dont il y en a 8 au dessus de la ligne latérale. L'anus s'ouvre immédiatement au devant de la base de l'anale, sur la moitié de la distance bomprise entre la fente des ouies et l'échancrure de la caudale.

Les nageoires de ce poisson présentent les particularités suiventes: Les pectorales naissent vers le bas sur la ligne du bord inférieur des opercules; elles égalent en longueur la tête et atteignent la base des ventrales; elles sont un peu pointues a leur angle superieur et arrondies à l'angle inférieur, où elles sont de plus de motié plus basses qu'en haut; leur bord postérieur est droit ou faiblement échancré. Les ventrales se prolongent jusqu'a la base de l'anale; elles sont d'un tiers plus courtes que les pectorales et leur bord inférieur est arrondi. L'anale est très-remarquable tant par sa longueur inusitée que par la nature des rayons dont elle est composée; ses rayons mitoyens sont d'un tiers plus longs que la pectorale, et se prolongent, lorsque la nageoire est couchée en arrière, jusqu'à la moitié de la ditsance comprise entre la base de la caudale et son échancrure. Les trois premiers rayons de cette nageoire sont mous, flexibles et indivisés, mais non pas applatis et à pointe arrondie comme les suivants; le troisième n'occupe que la moitié de la plus grande longueur de la nageoire, le deuxième est environ d'un tiers et le premier de deux tiers plus court que le troisième. Les quatre rayons suivants sont très-allongés, et tres-aplatis latéralement à leur moitié terminale. Les cinq derniers rayons, enfin, sont environ de moitié plus courts et également, mais moins sensiblement applatis. Les petites branches dont tous ces rayons applatis sont composés, se trouvent tout à fait rapprochées les unes des autres et nullement séparées par des membranes, ainsi que cela a ordinairement lieu dansles rayons mous des nageoires des autres poissons, de sorte quelles ne se présentent à la surface des rayons que sous la forme de stries longitudinales; encore arrive-t-il souvent dans le temps du frai, que ces branches sont entièrement cachées sous la matière muqueuse qui enduit ces rayons à l'époque que nous venons de signaler. Le dernier rayon de la nageoire fait seul une exception à cette règle, en ce qu'il est toujours visiblement divisé end eux branches. La caudale est profondément échancrée, son bord supérieur est toujours plus coust que l'inférieur. La dorsale naît vis-à-vis ou un peu en avant de la ligne d'aplomb de la base des ventrales; elle est peu étendue, et par derrière seulement d'un quart plus basse que par devant, où sa hauteur n'est que dun sixième plus considérable que la longueur des ventrales; ses deux rayons antérieurs sont indivisés et flexibles, et le premier est de moitié pluscourt que le second, qui est aussi long que le premier des rayons mous. D. 2+7, dont le dernier est double; A. 3+9, dont le dernier est divisè; V. 1+8; P. 1+16; C. 19, outre les rayons latéraux accessoires.

A juger de la figure que Mr. BÜRGER a fait faire sur un individu frais pris à l'époque du frai, figure que nous avons reproduite dans cet ouvrage, ce poisson est orné de teintes très-jolies. Le corps est d'un beau blanc-argenté, passant sur le dessus du dos au verdâtre. La tête est d'un vert olivatre foncé, tirant au jaune sur les opercules; mais tout le dessus de la tête, à partir de la ligne de l'angle de la bouche, est d'un rouge vermillon assez vif, et cette teinte se prolonge, en perdant cependant de son

intensité, le long de la poitrine et du ventre jusque vers l'anale, où elle s'efface insensiblement. Les nageoires sont d'un jaune, vif sur les ventrales, sale sur les pectorales et la caudale; la dorsale est d'un rouge vermillon à sa moitié antérieure, et toutes les membranes de cette nageoire sont noires jusque vers le tiers supérieur de leur longueur. Les fossettes de la tête sont d'un blanc pur, et l'iris de l'aeil est brun, à lexception du cercle rouge qui entoure la pupille. Les individus pris au temps du frai et conserves dans la liqueur forte, sont d'un jaune argenté, interrompu sur les côtés du corps par de larges bandes grisâtres, irrégulières mais très-peu apparentes. Le dessus tier au brun rougeâtre. Les nageoires sont d'un jaunâtre sale; les teintes rouges sont totalement effacées, et il ne reste des traces sensibles du noir que sur le milieu des membranes de la dorsale. Les individus mis dans l'esprit de vin avant ou après l'époque du frai offrent cette même distribution des couleurs, sauf que la teinte du fond est d'un beau blanc argenté.

Les dents pharyngiennes de ce poisson sont coniques et à pointe recourbé; elles sont disposées sur trois rangées, dont la première est composée de quatre, la mitoyenne de trois et la troisième de deux dents.

Les Japonais désignent cette espèce sous le nom de Hai. Elle se trouve assez généralement dans les rivières ou dans les equx stagnants. On la mange rarement, mais on la choisit souvent, à cause de ses teintes agréables, pour servir, à l'instar de la carpe dorée de la Chine, comme objet d'ornement dans les habitations.

Description:– Head 4; depth $3\,^1/_2$; D. III, 7; A. III, 9; P. 13; V. 10; Scales 43 in the lateral line; scales occasionally 9 from the origin of the dorsal fin to the lateral line, and from 39 to 45, usually 41 to 43, along the lateral line to the caudal base; 5 scales between the latter and middle of belly; pharyngeal teeth 5, 4, 2–2, 4, 4 may be 4 or 5 in the outer row; width of head $1\,^2/_3$ in length; snout a little over 3 in head; eye $4\,^1/_2$; interorbital space $2\,^3/_4$; pectoral 1; ventral $1\,^1/_3$.

Body elongate, compressed. Head moderate, compressed; snout slightly conical, pointed and not projecting; eye rather small, anterior and superior; mouth very oblique; jaws rather thin and about equal; maxillary protractile, and not extending to the margin of eye, but a trifle beyond nostrils; no barbels; pharyngeal teeth without grinding surfaces, and slightly hooked; nostrils close together on the sides of snout and nearer eye than the tip of snout; interorbital space and top of head rather broad and con vex. Gill-rakers short and pointed; pseudobranchiae present. Intestine short and with few turns. Peritoneum black. Scales rather large, and somewhat narrowly imbricated upon the sides; pectorals with small fleshy flaps; ventrals with a small, scaly flaps. Origin of dorsal much nearer the tip of snout than the base of caudal, when depressed, reaching beyond the origin of snout than the base of fin a little more than half the length of head; anal inserted a little nearer to the base of caudal than to the origin of pectoral, and the base of fin equal to three-fourths the length of head; caudal deeply emarginate and lobes sharply pointed; pectorals long, reaching the origin of ventrals; ventrals inserted below the origin of dorsal, and reach to the origin of anal. Caudal peduncle about as long as ventrals, and its least depth about half length. Lateral line strongly decurved and continuous to base of caudal.

The male is much larger than the female; measuring mostly 120–140 mm. body length in male and 100–110 mm. in female. The body of the male is larger than that of the female and the dorsal, anal, pectoral and pectoral fins of the male are larger than

those of the female. The nuptial color is very distinct, deep reddish brown from snout to head and lateral. The belly, pectoral, ventral and anal fins are bright reddish yellow and beautiful bluish green in irregular patterns. In the adult male, the pearl organs on the snout, upper and lower jaws, around orbit, preopercle, opercle, soft rays of anal fin and on caudal peduncle as well as on the scale margin.

Table 76. Measurements of *Zacco platypus* (TEMMINCK et SCHLEGEL).

Collection	Fish. Mie Univ.*				
Total length	149. 0mm.	131. 0mm.	129. 0mm.	131. 0mm.	101. 0mm.
Body length	124. 0	106. 7	105. 6	106. 5	83. 2
Body length/Head	4. 19	4. 10	4. 15	4. 30	3. 87
Body length/Depth	4. 32	4. 35	4. 22	3. 98	4. 01
Body length/Predorsal length	2. 10	2. 09	2. 11	2. 08	2. 02
Body length/Prepectoral length	4. 34	4. 63	5. 03	4. 95	4. 50
Body length/Preventral length	2. 18	2. 09	2. 11	2. 13	2. 02
Body length/Preanal length	1. 55	1. 54	1. 49	1. 48	1. 44
Head/Snout	3. 52	3. 17	3. 11	3. 10	2. 07
Head/Upper jaw	3. 12	3. 06	3. 07	2. 99	2. 94
Head/Interorbital width	2. 80	2. 96	3. 00	2. 92	2. 94
Head/Diameter of Eye	4. 93	4. 34	4. 25	4. 13	3. 77
Head/Length of Caudal peduncle	1. 33	1. 33	1. 34	1. 22	1. 39
Head/Depth of Caudal peduncle	2. 70	2. 66	2. 55	2. 48	2. 76
Head/Length of Dorsal fin	1. 87	1. 97	2. 22	1. 95	2. 39
Head/Length of Anal fin	1. 33	1. 30	1. 38	1. 44	1. 87
Head/Height of Dorsal fin	1. 19	1. 30	1. 27	1. 17	1. 32
Head/Height of Anal fin	0. 65	0. 69	0. 74	0. 70	0. 85
Head/Pectoral length	1. 02	1. 19	1. 11	1. 06	1. 37
Head/Ventral length	1. 48	1. 46	1. 47	1. 42	1. 84
Date	VIII, 1951				
Locality	Lake Biwa, Shiga Prefecture				

* Faculty of Fisheries, Prefectural University of Mie.

Coloration: Color in alcohol, dark bluish black above, the lower surface of the body silvery, and the sides with about 12 lead-blue cross-bands; dorsal grayish with black streaks in the middle of the fin and between each pair of rays; caudal grayish; the other fins whltish with the anal tinged with grayish; sides of the head more or less grayish black. In life steel blue, the male with crimson fins.

Habit: This species is the most widely distributed cyprinoid fish; found in Manchuria, China, Korea, Formosa and Japan. It is widely distributed throughout Japan proper, except in the Hokkaidô and Tôhoku districts. The fish mature in 2–3 years. Around Tôkyô, the breeding season occurs in the end of May and the beginning of August, the spawning ground is selected in a shallow, clear current, shallow and shinny sandy or pebbly bottom. In the spawning season, the adults search for the small streams or clear shallow waters to deposit their eggs on gravel or submerged wood. As mentioned above, the breeding males are provided with numerous large, hard, horny pearl organs on the snout, cheek and on the ventral fins as well as on the long anal rays. The pearl organs on the cheeks are united basally to form a plate, but those on the lower

side of the caudal peduncle are very small, several to a scale. The anal fin is enormously developed, and extends far beyond the caudal base. The nupital color is distinctly represented in the males during the breeding season. A very beautiful reddish color appears on both sides of the body and fins. The forehead and ventral side of opercular region are dark green. Young specimens are silvery and with distinct grayish or pale brownish lateral bands posteriorly.

Eggs are cubical, bright yellow, measured 1.7–1.9 mm. in diameter. They hatch out in 50–60 hour safter fertilization. The just hatching larva is 4.3–6.1mm. in body length and begins to swim a out 90 hours after hatching out. At that time, the larvae. moves the tail and stays in the middle of the water. The youngs are swimming along the coast of river and gradually move into the deep. They are catching pelagic and minute algae. When they grow 8.5–9.5mm. long, they move atively and catch small worms, crustacean larva. The adult fish mostly take small crustaceans end aquatic insects. They are found in the middle of the clear running waters and very heavy in swimming.

There are found many micro-algae, (*Navicula*, *Microsistis*, etc.) and microscopic animals (*Rotifera* and larvae of *Cladocera*), in the stomachs of the pelagic young of 7 to 10 mm. total length. As the young grow up to 15–20 mm. total length, *Rotifera*, *Crustacea* (*Cyclops* and *Bosmina*) and larvae of aquatic insects were taken as nourishment. In the young stage, the stomach contents had almost the same composition as that of the adult, i.e., Insects, Crustacea, dirt and vegetable matter consisting of water plants.

Development:-- Egg: Nearly spherical, 1.7–1.9 mm. in diameter; transparent; diameter of yellow yolk sac measures 1.1 mm. in the diameter. The eggs adhere rather loosely to the clear gravel or submerged wood. The incubation period lasts about 50–60 hours at water temperatures of 25′–29°C.

Larva: Newly hatched larva, total length, 4.40 mm.; length to vent, 3.30 mm.; diameter of eye, 0.33 mm.; myomeres about 20 to vent plus 17 behind (incomplete). One characteristic is a very large yellow club-shaped yolk sac, consisting of a very large bulbous portion extending posteriorly to the vent. Larva quite colorless, even eyes unpigmented; mouth and vent not open.

Juvenile of 1-day old: Total length, 6.10mm.; head length, 0.63mm.; diameter of eye, 0.34 mm. In this stage, the eyes of the juvenile are first pigmented blackish gray and later a large area of black pigment appears on the top of the head and along the margin of the intestine.

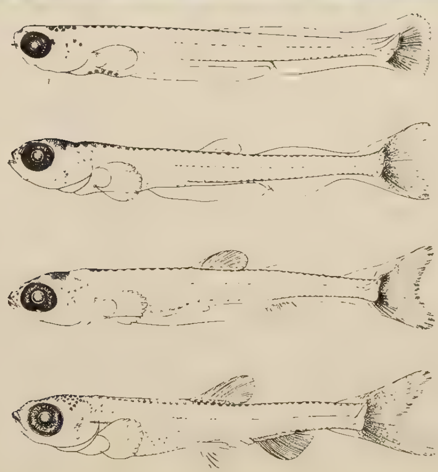
Two days after hatching out the juvenile have has many large areas of black and yellow pigments as seen from the dorsal aspect. After a short period, the pectoral fins develop and the mouth and opercle begin to be movable.

Juvenile three days old: Total length, 6.36 mm.; greatest depth before vent, 0.74 mm.; head length, 1.05 mm.; diameter of eye, 0.47mm.; snout length, 0.10 mm. Pectoral fin well-developed and air bladder begins to appear. The large stellate black pigmented on the head is continued in two irregular series on the dorsal ridge, and those on the undersurface are increased at the intestinal aspect, starting just before the ventral. A single



1

2



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4

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6

1. ***Zacco platypus*** (Temminck et Schlegel). ♂
2. ***Zacco platypus*** (Temminck et Schlegel). ♀

Development of ***Zacco platypus*** (Temminck et Schlegel). after K. Uchida.

3. Juvenile, 6.7 mm. in body length.
4. Juvenile, 8.2 mm. in body length.
5. Juvenile, 9.0 mm. in body length.
6. Young, 12.0 mm. in body length.

series of linear shaped chromatophores make a middle line on the lateral surface.

Young of 7.2 mm. total length: body length, 6.50 mm.; body height, 0.80 mm.; head length, 1.33 mm.; diameter of eye, 0.57 mm. snout length, 0.19.; air-bladder, in total length, about 1 to 7; myomeres 23 to vent plus 21 behind. Body elongated and slender with a rather eye and well-developed air-bladder, position of the dorsal fin indicated by a concentration in the marginal fin fold, which persists behind the dorsal as a marginal band continuous with the heteroceracal caudal; caudal rays formed but distal margin remains as the fin fold. Two or three series of black pigment run from the top of the head to the caudal fin and also over the air-bladder as well as on the base of the pectoral fins and cheeks.

Under the surface on the dorsal ridge of the notochord rise linear black chromatophores which form a single series running from the head to the caudal. The black pigment extends over the intestines and runs along the ventral ridge of the anal to the caudal fins. Four large stellate black chromatophores appear in the caudal rays.

Young of 11.0 mm. body length: Total length, 11.06 mm.; body height, 1.55 mm.; head length, 2.3 mm.; diameter of eye, 0.78 mm.; snout length, 0.36 mm.; myomeres 23 to vent plus 18 behind. Body rather stout; mouth oblique; caudal fin rayed and deeply forked. Ventral fin developing; air-bladder two-chambered, embryonic marginal fins persist behind dorsal and in front of ventral. The characteristics of pigmentation are essentially the same as those of the previous stage. The snout and inner opercular region are pigmented. About twenty-two (fewer than those of *T. hakonensis*) large roundish chromatophores exist on the top of the head, and extend over the dorsal margin of the body to the caudal in two or three irregular series.

Young with 13.3 mm. body length: Total length, 13.32 mm.; body length, 11.35 mm; body height, 2.11 mm; head length, 2.63 mm; diameter of eye, 0.91 mm; snout length, 0.49 mm. Body moderately stout, fusiformed. All of the fins are completely developed except the anal which is not yet showing an elongated form. Mouth oblique and length of snout measuring one-half of the diameter of the eye. Chromatophores are distributed thickly on the top of head, on both jaws and on the cheeks. On the dorsal aspects large and small chromatophores prevail irregularly. Very stellate chromatophores appear on the middle region of the body just between the opercle and vent. Iridocyte, metalic blue pigment appears on the inner surface of the alimentary canal.

Type locality: Nagasaki.

Distribution: Sungari, River Yaru, Liao-ho (Manchuria), China from Hopei to Hainan, western Korea, Japan, Formosa.

In Japan Nagasaki (Temminck & Schlegel); Tsutiura, Ibaragi-Prefecture; River Kinu, Utsunomiya; River Yodo, Osaka; River Chikugo, Kurume; River Yabe, Hunayado, Nagoya; River Tama, Tachikawa; Kawamata, Nagasaki; Lake Biwa, Matsubara (Jordan, Fowler); Otsu, Lake Biwa (Jordan, Kawamura); Kumamoto (Wakiya); Himezi (Abe); Okayama (Mikamo); Lake Suwa (Jordan); Fukuoka (Hamada); Kasumigaura

(HATTORI); Lake Mikata, Fukui; River Kati, Nagoya (JORDAN); Lake Biwa (SAUVAGE); Hikone, Matsubara (ISHIKAWA); Lake Tega, Shimosa; Fukiage, Tôkyô; River Chi, Musashi; Chichibu; Lake Suwa; Ise; Kishû; Lake Biwa; Zeze, Kyôto; River Tsuyama (ISHIKAWA); Motoyama; Iwaide, River Anraku, Kishû; Gozyo, Nara Pref.; Yuasa, Tatsugahama; Gobo, Wakayama Pref.; Hashimoto (OKADA & NAKAMURA); Japan except in the Hokkaidô and Tohoku Districtis (OKADA & NAKAMURA); Honshû, Shikoku, Kyûshû (UCHIDA); River Tone (ISHIKAWA, TAKATSUKA, AOYAGI); River Shinano (TANAKA, MINAGAWA, SAWAGURI); River Mogami; River Hyûga (HASHIMOTO; this was introduced from Lake Biwa together with young *Plecoglossus altivelis* which were transplanted during 1928 and 1932). River Yoshino, Shikoku (TANAKA, KASAI); Motoyama; River Niyodo, Kôchi Prefecture; (KAMOHARA); Miyazaki Prefecture (AOYAGI); Kagoshima Prefecture (OGAWA).

72. Zacco temmincki (TEMMINCK et SCHLEGEL).
"Kawamutsu, Mutsu, Akamutsu"
(PL. XXXV, figs. 1–3)

Leuciscus temmincki TEMMINCK et SCHLEGEL, 1846, Faun. Japon. Poisson., p. 210, pl. 101, fig. 4. – RICHARDSON, 1846, Rept. Brit. Assoc. Adv. Sci., p. 300.

Zacco temmincki JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., XXVI, p. 852. – TANAKA, 1908, Annot. Zool. Jap., VII, p. 6; TANAKA, 1908, Zool. Mag. no. 237, p. 235. – TANAKA 1909, Annot. Zool. Jap., VII, p. 134. – SNYDER, 1912, Proc. U. S. Nat. Mus., XLII, p. 404. – JORDAN et METZ, 1913, Mem. Carn. Mus., VI, p. 21. – JORDAN, TANAKA et SNYDER, 1913, Journ. Coll. Sci. Tôkyō, 33, p. 75. – JORDAN et THOMPSON, 1914, Jour. Coll. Sci. Tôkyô, 6, p. 232. TANAKA 1914, Fig. Desc. Fishes Jap., XVII, pl. 81, fig., 275. – TANAKA, 1914, Ibid. XVIII, p. 296 – OSHIMA, 1919, Ann. Carn. Mus., X, p. 238. – TANAKA, 1921, Nihon Gyogaku, p. 193 – MIYADI, 1924, Kyotofuka no Tansuigyo, pp. 32–33, pl. 4, fig. 30 – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 186–187. – CHU, 1931, Biol. Bull. St. John's Univ., no. 1, p. 30. – OKADA, MATSUBARA et UCHIDA, 1935, Nihon Gyorui Zusetsu, p. 86, pl. 31, fig. 2. – OKADA et MATSUBARA, 1938, Keys Fish. and Fish-like Anim. Japan, p. 77. – UCHIDA, 1939, Bull. Fish. Exp. Sta. Tyôsen. no. 6, pp. 339-346, pl. 34, figs. 1–7; pl. 39, figs. 1–2. – OKADA et NAKAMURA, 1948, Nihon no Tansui Gyorui, pp. 172–173, fig. 97. – KAMOHARA, 1950, Descr. Fish. Prov. Tosa, Kishû, Japan, pp. 45–46.

Zacco sieboldi JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., XXV,I pp. 854–855.

Zacco mitsukurii ISHIKAWA, 1904, Proc. Dept. Nat. Hist. Tôkyô. Univ. vol. 1, p. 4, pl. 1, fig. 1.

Leuciscus sieboldii SCHLEGEL, 1846, Faun. Japon. Poisson, p. 211, pl. Cl, fig. 5.

Opsariichthys sieboldii GÜNTHER, 1868, Cat. Fish., VII, p. 295. – SAUVAGE, 1883, Bull Soc. Philom., p. 5.

Zacco sieboldi JORDAN et FOWLER, 1903, Proc. U.S. Nat. Mus., 26, pp. 853-854. – TANAKA, 1908, Annot. Zool. Jap., VII, p. 6. – TANAKA, 1908, Zool. Mag., no. 237, p. 235. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., VI, p. 232.

Zacco mitsukurii ISHIKAWA, 1904, Proc. Dept. Nat. Hist. Tôkyô Univ. I, p. 4, pl. 1, fig. 1.

Zacco mitsukurii var. a. ISHIKAWA, 1904, Proc. Dept. Nat. Hist. Tôkyô Univ., I, p. 5, I, II, fig. 2.

Opsariichthys temmincki GÜNTHER, 1868, Cat. Fish. Brit. Mus., VII, p. 295. – MATSUBARA, 1880, Jap. Intern. Fisch. Augst. Berlin, p. 17. – NAMIYE, 1881, Class. Cat. Spec. Vert., p. 107. – SAUVAGE, 1883, Bull. Soc. Philom. p. 5. – ISHIKAWA, 1896, Zool. Mag., VII, p. 121. – ISHIKAWA et MATSUBARA, 1897, p. 11.

Barilius temmincki ISHIKAWA, 1897, Prel. Cat., p. 11. – JORDAN et SNYDER, 1901, Check-list Fishes Japan, p. 47.

The original description* is as follows:

Leuciscus Temminckii
Pl. Cl, fig. 4.

Cette espèce offrant une tête plus grosse, ees écailles beaucoup plus petites et un rayon de plus à l'anale que les précédentes, il est très-facile de l'en distingueur. Nous en possédons une sixaine d'individus, de deux pouces et demi à cinq pouces de longueur.

La grosseur du corps est deux fois et un tiers dans sa hauteur, qui entre quatre fois et demie dans la longueur comprise entre l'échancrure de la caudale et l'extrémité du museau. La longueur de la tête est un peu plus considérable que la hauteur du corps. La longueur du museau surpasse un peu le diamètre de l'aeil et est trois fois et deux tiers dans la tête. L'entre-deux des yeux, enfin, est de moitié plus large que le diamètre de ces organes. Le dessus de la tête est arrondi vers le côté comme d'ordinaire et n'offre, ainsi que les narines, rien de particulier. La bouche étant plus fendue que dans les espèces précédentes, le maxillaire se prolonge jusque sous l'aplomb de la fin du premier tiers du diamètre de l'aeil. La fente de la bouche forme avec l'axe longitudinal du corps un angle très-aigu, et la mâchoire inférieure dépasse tant soit peu la supérieure. La largeur des sous-orbitaires mitoyens égale le tiers du diamètre de l'aeil; l'antèrieur sont de moitié plus larges. Les bords du préopercule forment un angle droit; l'opercule est assez arrondi. La tête est revêtue d'une peau une et pourvue, comme dans la première espèce de plusieurs rangées de fosettes, mais on ne voit pas de ces fossettes sur le bas du préopercule ni sur l'opercule, et elles sont dans les individus de petite taille, moins développés et en nombre moindre que dans les adultes. La ligne latérale, semblable à ce que l'on observe dans les espèces precédentes, descend dés son origine vers le bas, et arrivée vis-à-vis de la base des ventrales, elle se prolonge en direction à peu près droite sur la ligne du quart inférieur du poisson, jusqu'à la base de la caudale. Les écailles ressemblent, par leur structure et leur forme, à celles des espèces précédentes; elles sont cependant un peu plus arrondies, et beaucoup plus petites; on en compte 50 environ sur la ligne latérale, et entre le dos et le ventre 20 rangées, dont 10 au dessus de la ligne latérale. L'anus s'ouvre immédiatement au devant de l'anale, sur la fin du deuxième tiers de la longueur comprise entre l'extrémité du museau et la base de la caudale.

Les pectorales naissent sur la ligne du bord inférieur du préopercule; leur longueur fait quatre cinquièmes de celle de la tête, elles sont arrondies vers le bas, et leur extrémité est éloignée de lá base des ventrales à une distance égalant un quart de leur longueur. Les ventrales sont d'un cinquième plus courtes que les pectorales, et leur pointe est élolgnée de l'anus à une distance égale à plus d'un tiers de leur longueur. La longueus de l'anale surpasse d'un quart celle des pectorales; couchée en arrière, cette nageoire se prolonge jusque sur la base des petits rayons latéraux de la caudale, qui est divisée en deux lobes égaux au moyen d'une échancrure assez profonde. La dorsale nait vis-à-vis de l'aiselle des ventrales; elle est d'un tiers plus basse par derrière que par devant, où sa hauteur ne surpasse que de très-peu la longueur des ventrales. D. 2+7; A. 3+10; V. 1+8; P. 15; C. 18.

Les individus conservés dans la liqueur forte sont de couleur argentée tirant au rougêatre sur le dessous et passant au brun rouge sur le dos. On voit le long du milieu de chaque côtê du poisson, une raie d'un bleu noirâtre pâle, plus distincte et mieux déterminée vers le derriere que vers le devant. Les nageoires sont jaunâtres; mais les mcmbranes de la dorsale et le plus souvent aussi celles de l'anale sont teintes de noirâtre au milieu. Toutes les écailles des deux tiers supérieurs du corps sont parsemées d'innombrables petits points noirâtres.

Description: Head $3^2/_3$; depth $3^3/_4$; D. III, 7; A. III, 10; P. I. 15; V. 9; scales 52 in the lateral line; 11 scales between the origin of the dorsal and the lateral line, and 6

* TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poisson, p. 210.

scales between the latter and the middle of the belly, pharyngeal teeth 5, 4, 1–1, 4, 4; width of head 2 in its length; snout 4 in head; interorbital space 3; pectoral $1\,^{1}/_{4}$; ventral $1\,^{2}/_{3}$. Body moderately elongate and compressed; caudal peduncle much compressed. Head moderately large and compressed; snouts slightly conical, pointed and not projecting; eye high, lateral; nostrils close together, nearer to eye than to tip of snout; mouth terminal, oblique, jaws moderately thick and about equal; maxillary protractile and reaching beyond the anterior margin of the orbit; no barbels; no teeth on jaws; preopercle smooth, the angle roundish but the two limbs at a right angles to each other; opercle also smooth, with narrow fleshy flap which runs parallel to the opercular margin; pharyngeal teeth without grinding surfaces and slightly hooked; interorbital space and top of head rather broad and convex. Gill openings large; gills 4 in number; gill-lakers on first gill arch short, stout and pointed, 4 + 7; pseudobranchiae developed. Scales moderately large, cycloid and somewhat narrowly imbricated along the sides; pectoral with a small, fleshy flap; ventral with a pointed, scaly flap. Horny tubercles slightly developed on preorbital and suborbital parts. Origin of dorsal midway between tip of snout and base of caudal; when depressed, reaching slightly beyond the origin of anal; inserted a little nearer tip of pectorals than base of caudal, and its base 2 in head. Caudal deeply emarginate, lobes pointed; pectorals long and terminating near the origin of the ventrals; ventrals reaching for three-quarters the distance to origin of anal. Caudal peduncle $1\,/^{1}_{2}$ and its least depth $2\,^{3}/_{5}$ in head. Lateral line strongly curved and continuous to base of caudal peduncle.

Coloration: Color in alcohol dark brown above, pale or silvery below; sides with a distinct deep brown lateral band, broader and darker posteriorly; dorsal and caudal grayish, the former with dark streaks between the fin rays, and the other fins more or less pale.

Secondary sexual characters: The male is larger than the female, measuring 130–170 mm. in male and 110–130 mm. in female. The dorsal fin of the male is larger than that of the female. In the male, the anal fin is very thick and slender, spatulated, provided with very long 2–4 soft rays. The ventral fin of the male is long, rounded and its end is reaching the anus, while in the female the ventral fin is short and pointed at the end which can not reach the anus. The pectoral fin of the male is also longer than that of the female. The nuptial color is very distinct as shown in *Zacco platypus*. The ventral side of the male has a deep bricky colour and it is bright reddish orange on the belly and lateral. The anterior margin of the dorsal and pectoral fins is very bright reddish yellow and also the caudal fin is deep red. In the male. pearl organs appear on the snout, upper and lower jaws, around the orbit, preopercle, opercle, the soft ray of anal fin and the lower of caudal peduncle. UCHIDA reported, that even in the female small pearl organs appeared on the lateral side of snout and on the below of orbit.

The pearl organs occur on the body as in *Zacco platypus*. From the study of the pearl organs in the Japanese Cyprinoid fishes,* the present species may be included under the

*OKADA, Y., 1934, Scien. Rep. Tôkyô Bunrika Daigaku, sect. B, no. 28 pp. 29-36, pl. v, figs. 2-3.

Table 77. Measurements of *Zacco temmincki* (TEMMINCK et SCHLEGEL).

Collection	Fish. Mie Univ.*				
Total length	146. 0mm.	175. 0mm.	95. 0mm.	87. 5mm.	60. 0mm.
Body length	119. 0	141. 0	75. 0	70. 1	46. 3
Body length/Head	4. 04	3. 86	3. 44	3. 50	3. 42
Body length/Depth	3. 88	3. 36	3. 84	3. 96	3. 96
Body length/Predorsal length	2. 00	1. 93	1. 92	1. 89	1. 89
Body length/Prepectoral length	4. 21	3. 98	3. 86	3. 82	3. 56
Body length/Preventral length	2. 06	1. 90	1. 91	1. 93	1. 95
Body length/Preanal length	1. 41	1. 42	1. 40	1. 44	1. 42
Head/Snout	3. 60	3. 20	3. 64	3. 51	3. 65
Head/Upper jaw	2. 89	2. 80	2. 63	2. 74	2. 88
Head/Interorbital width	2. 46	2. 35	2. 80	2. 94	2. 88
Head/Diameter of Eye	4. 68	4. 68	3. 41	3. 71	2. 82
Head/Length of Caudal peduncle	1. 30	1. 64	1. 77	1. 60	1. 63
Head/Depth of Caudal peduncle	2. 42	2. 40	2. 73	2. 78	3. 00
Head/Length of Dorsal fin	2. 08	2. 25	2. 83	2. 67	2. 88
Head/Length of Anal fin	1. 61	1. 60	2. 18	2. 17	2. 33
Head/Height of Dorsal fin	1. 18	1. 52	1. 58	1. 47	1. 38
Head/Height of Anal fin	1. 08	1. 21	1. 56	1. 54	1. 80
Head/Pectoral length	1. 17	1. 13	1. 34	1. 38	1. 35
Head/Ventral length	1. 37	1. 49	1. 77	1. 77	2. 14
Date	VIII, 1951				
Locality	Lake Biwa, Shiga Prefecture				

* Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

subgroups *f*, *g* and *h* of the first group and *b* subgroup of the second group and the third group. The most prominent ones on the body are those along the ventral margin of the caudal peduncle. The scales located on that region have pointed tubercles at their ends, so that caudal peduncle presents a spiny appearance in the side view. Some scales on the posterior part of the body are provided with several minute tubercles on their surface causing a roughness of the body surface. These characters have some special purpose during the breeding season. This may be true of some of the Japanese Cyprinoid fishes, which may deposit their eggs on the surface of rocks in the water. Before the deposition of eggs by the female, the male cleans the algae and other coating from the surface of the rocks, preparing a clean surface on which the eggs may be deposited. Dr. CARL L. HUBBS has informed me that he observed the males of the present species thus cleaning rocks in Lake Biwa. During the breeding season, we have often seen certain freshwater fishes of this group moving quickly against rocks in the water. Such action may be undertaken by the males for the purpose just mentioned above. In this connection, it is interesting to note that the pearl organs of Japanese Cyprinoid fishes develop mostly about the tip of the snout on the side of the face. The tubercles probably serve as contact organs, holding the mating pairs entangled by increasing the roughness of the surfaces on the body of the male which come into contact with the body of the female. The first appearance of the pearl organ was observed by the author[1)] in the adult of 68 mm. body length; while that described by UCHIDA* was a

*UCHIDA, K., 1939, Fishes of Tyôsen, Bull. Fish. Exp. Sta. Tyôsen, no. 6, pp. 345–346.

young of 25 mm. body length. In the mating season, the male has a light orange ground color, and is dark greyish on the back and gradually lighter towards the belly. The head light red with a somewhat broad, black, longitudinal band along the midateral lne. The dorsal side of the head is some-what deeply dark greyish. Female light yellow without red markings and with a black band on the lateral line, white on the belly.

The nupital colors are also exhibited on the males during the breeding season. Sometimes the nupital colors last until the winter season.

Habits: The habits nearly resemble those of the former species *Zacco platypus*, but this species has a more limited distribution. Food habits, omnivorous, taking insects, insect larvae, crustaceans, shells and worms, as well as algae. The fish mature in 2–3 years. The breeding season is somewhat earlier than for *Zacco platypus*, occuring from the end of May to the end of June, around Lake Biwa.

This fish also likes to live in the clear middle current of the river, and sometimes is found together with *Zacco platypus* in the same area. This fish has a strong resisting power with a serious drought; when even the river is dry in summer they can live longer in the steady water which is formed temporally. The food is consisting of aquatic insects, sometimes of roots or leaves of weeds as well as green algae.

Development: The early development has not yet been studies by Japanese Ichthyologists. The juvenile closely resembles that of *Zacco platypus* but differs slightly in the size of the eye and the rate of fin development. In the adult stage, the present species has larger eyes, while in the embryonal stage the eyes are smaller than those of *Zacco platypus*. At the complete formation of anal fin, the branched rays of the anal fin are numbered 10 in this species and 9 in *Zacco platypus*.

The larva of 9.0 mm. body length, may be a juvenile stage, has a slender body with a large eye and short rounded snout. Upper jaw has not yet well-developed. Anus opens about $^2/_3$ from the anterior end of body. Myotomes $18+14=32$ in number. The dorsal membranous fin nrrow, starting somewhat anteriorly from the middle of the body. The ventral membranous fin rather broad, starting out at about $^1/_3$ anteriorly of the trunk. The anal fin has not yet separated from the caudal membranous fin. Pectoral fin is fan-shaped. The distinct black chromatophores appear on the body. The arrangement is nearly the same as on *Zacco platypus*. They are arranged in linear series along the demarcation line between the upper and lower muscle layers, starting from the middle of the abdomen. They are also arranged on both sides of the mid-ventral line posteriorly beginning at the anus.

A small group of black chromatophores is present on the interorbital space and other distinct ones are distributed from the tip of the snout to the post-occipital, connecting with a posterior dorsal longitudinal line. Small groups of black chromatophores are found on the sides of the occipitals.

A small black chromatophore often occurs at the base of caudal fin.*

The young of 12.0mm. body length has a complete mouth and complete dorsal and

*Jordan et Fowler, 1934, Proc. U. S. Nat. Mus, vol. xxvi, no. 1334, p. 853.

PLATE XXXV



1



2



3

1. ***Zacco temmincki*** (TEMMINCK et SCHLEGEL). ♂
2. ***Zacco temmincki*** (TEMMINCK et SCHLEGEL). ♀
3. ***Zacco temmincki*** (TEMMINCK et SCHLEGEL). ♂

anal fins. The membranous fin remained only on the posterior part of the dorsal and anal fins, and on the anterior part of the ventral. The caudal fin is slightly forked.

Myomeres $25+17=42$ in number. The arrangement of black chromatophores is not changed. The chromatophores on the air-bladder and alimentary canal grow larger, and those on the lateral sides of body arranged along the longitudinal line. The dorso-longitudinal lines of black chromatophores grow broader anteriorly. Small groups of blak chromatophores are scattered on the latero-dorsal and vento-lateral sides of the body. Other linear series of black chromatophores can be seen along dorsal and ventral to the vertebrae through the lateral muscle layers.

Remarks: JORDAN et FOWLER described *Zacco sieboldi* (SCHLEGEL) from many specimens collected at Lake Biwa, Matsubara, the River Chikugo at Kurume, near Nagoya in Owari, Kibami in Ômi, Funayado in Kyushû and Karasaki on Lake Biwa. Originally, SCHLEGEL mentioned *Leuciscus sieboldii* from the type specimen collected at Nagasaki and Omura in the "Fauna Japonica". But this species may be the same as *Zacco temmincki* from the characters mentioned by these authors.

JORDAN and HUBBS* pointed out the wide variation of scale rows and showed no very definite geographical correlation with the number of scales. They added that the average number exhibited in the specimens from Lake Biwa was high.

Type locality: Nagasaki.

Distribution: Manchuria; China; Korea and Japan; Kawatana, Nagasaki; Mogi River, Nagasaki (JORDAN & FOWLER); Hamada; Kumamoto; Oza; Shikoku; Lake Biwa (WAKIYA); Mikawa Bay (ISHIKAWA); Himezi (ABE); Okayama (MIKAMO); Fukuoka (HAMADA); Yamaguchi (JORDAN, HUBBS); Lake Biwa, Matsubara; River Tikugo, Kurume; Nagoya; Kibami Omi; Hunayado, Fukuoka; Karasaki, Lake Biwa (JORDAN, FOWLER); Shikoku; Mikawa Bay; Hondo, Drainage of Inland Sea; Hamada, Drainage of Sea of Japan; Kyushû; Lake Biwa (JORDAN, HUBBS); Hikone; Matsubara; Ôtsu (ISHIKAWA); Zeze, Kishin, Matsubara (JORDAN & FOWLER); Shiga Pref.; Kôchi Pref.; Hiroshima Pref.; Tôkyô; Yamaguchi Pref.; Kumamoto Pref.; Wakayama Pref.; Hyôgo Pref.; (OKADA, MATSUBARA & UCHIDA); Honshû (west from the middle part of Honshû); Shikoku; Kyûshû (OKADA & NAKAMURA); Tosa; Tanabe; Koya; Iro-River; Shingu; Iwaide; Tanaka; Hashimoto; Myozin; Kushimoto; Yuasa; Tanabe; Gobô (KAMOHARA); Hakone; Ôtsu; Lake Biwa (JORDAN et SNYDER); Ibamura, Kamisaki-gun; Kihama; River Seta; Hikone; Omi Prov.; Okayama; River Asahi; Mimasaku Furu Machi; River Mitoya, Izumo; River Nagara, Mino; Inukaike, Owari; River Katsura, Yamashiro; River Bessyo, Odamura, Mimasaaku; Kôchi, Tosa; Biwa Lake; River Iu; Imaichi; Izumo; Ogura Ike, Yamashiro; Inbe River, Ise; Gifu; Fushimi, Minô; Hakone; Takagimura, Naka-Gun, Iwami Prov.; Yoshihiki, Suwô; Ono; Suwô; Nakatsu, Buzen; Saga Hizen; Ôdai, Yoshiimura, Kogetsugun, Bityû; Kamihomura, Gunzyogun, Minô; Chikuden, Bungo; Sadamitsu, Awa; Hashimotochô, Itogun, Kishû; Hachirogata,

* JORDAN & HUBBS, 1937, Mem. Car. Mus., vol. x, no. 2, p. 187.

Bungo; Onomachi, Echizen; Ôgaki; Hatsuemura, Kasagun, Tango; Handa, Awa (TANAKA); River Ota; Tenryu River, Shizuoka Prefecture (OKADA); Nagano Prefecture; River Kuzuryu, Fukui Prefecture (AOYAGI); Kagawa Prefecture (AOYAGI); Ehimi Prefecture (ISHIKAWA, TANAKA); River Yoshino, Kôchi Prefecture (TANAKA, KASAI, KAMOHARA); Miyazaki Prefecture (AOYAGI); Kagoshima (OGAWA).

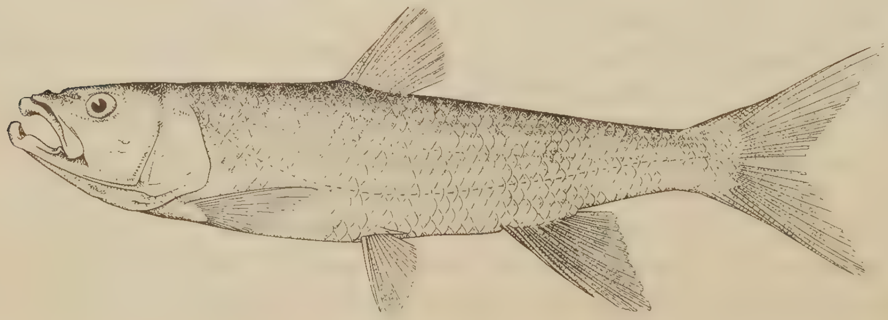
Genus Opsariichthys BLEEKER, 1865.

Opsariichthys BLEEKER, 1865, Atl. Ichthyol. Cyprin. p. 280.
Type: ***Opsariichthys uncirostris*** Type Locality: near Nagasaki.

Characters: Body elongated, oblong, and compressed. Head rather pointed, greatly compressed, and the sides flattened; snout long; eye small, high; mouth large, very oblique, the maxillae reaching the anterior margin of the eye, and with a deep notch into which each ramus of the mandible fits; no barbels; teeth 5, 4, 2–2, 4, 5, on long, thin, pharyngeal bones; interorbital space broad flat. Gill-rakers short, $3+9$. Intestine short, peritoneum silvery. Scales moderate, about 50, and more or less narrowly imbricated; pectoral flap short. Origin of dorsal fin midway between the tip of the snout and the base of the caudal fin, base of anal fin long, with 9 developed rays, and its origin falling a little anterior to the tip of the depressed dorsal fin; caudal fin deeply emarginate; ventral fins inserted below the origin of the dorsal fin. Lateral line complete and decurved. Breeding males have the head, lower surface of the caudal peduncle, and the anal fin furnished with numerous small horny tubercles. Rays of anal fin elongated and more or less adipose.

73. Opsariichthys uncirostris (TEMMINCK et SCHLEGEL).
"Hasu"
(Text-fig. 87).

Opsariichthys uncirostris GÜNTHER, 1868, Cat. Fish. Brit. Mus., VII; p. 295. - SAUVAGE, 1883, Bull. Soc. Philom., p. 5. – ISHIKAWA, 1895, Zool. Mag., VII, pp. 121-125, figs. 1-3. – ISHIKAWA, 1897., Prel. Cat., p. 12. – JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., XXIII, p. 344. – JORDAN et



Text-fig. 87. ***Opsariichthys uncirostris*** (TEMMINCK et SCHLEGEL). ×½

SNYDER, 1901, Ann. Zool. Japan III, p. 47. - JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., XXVI, no. 1334, pp. 855-857. - JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Japan, p. 75. - JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. VI, p. 232. - JORDAN et HUBBS, 1925, Mem. Car. Mus., vol. X, no. 2, p. 188. - TANAKA, 1927, Fig. Desc. Fish. Japan, pp. 862-865, pl. 179, fig. 489. - MIYADI, 1935, Kyôto fuka no Tansuigyo, p. 33, pl. 5, fig. 31a. - EBINA, 1931, Nihon Zyuyo Gyorui Zushu, Pl. 36.- OKADA, 1934, Sc. Rep. Tôkyô Bunrika Daigau, Sect. B, No. 28, pp. 29-36, pl. IV, figs. 5-6. - OKADA, MATSUBARA et UCHIDA, 1935, Nihon Gyorui Zusetsu, pl. 31, fig. 1. - OKADA et MATUSBARA, 1938, Keys Fish & Fish-like Anim. Japan, p. 77. - OKADA et NAKAMURA, 1948, Nihon no Tansui Gyorui, pp. 173-174, fig. 98.

Leuciscus uncirostris TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poiss., pp. 211-213, pl. C III, fig. 2.

The original description* is as follows:

Leuciscus uncirostris, Pl. CII, fig. 1.

Les caractères que nous venons de signaler sous le numero B, étant uniquement propre à l'espèce appelée par nous *Leuc. uncinatus*, et ces caractères étant très-saillants et tout à fait inusités dans la famille des Cyprinoides, il est facile de reconnaitre au premier coup d'oeil cette espèce remarquable, qui offre du reste par son organisation en géneral et ses formes, beaucoup de rapports avec les précédentes; sa tête cependant est plus grande, le corps est moins élevé et l'anale moins développée. Nous n'en avons recuque trois individus, un de plus de cinq pouces et demi, les deux autres d'environ quatre pouces et demi en longueur.

La grosseur du corps pres du commencement de la dorsale est deux fois et un tiers dans sa hauteur, qui égale la longueur de la tête sans l'opercule, et est environ cinq fois dans la longueur compries entre l'extrémité du museau et l'echancrure de la caudale; la longueur totale de la tête y est cinq fois. La longueur du museau est de moitié plus considérable que le diamètre de l'oeil, et occupe le tiers de la longueur de la tête. L'entre-deux des yeux, enfin, est de plus d'un tiers plus large que le diamètre de ces organes. Les narines, comme à l'ordinaire doubles, s'ouvrent sur les côtés de la face supérieure du museau, et elles sont presque trois fois plus éloignées de l'extrémité du museau que du bord de l'orbite. La ligne du dessus de la tête est à peine arquée, et cette partie de la tête, à partir du devant du front, presque tout à fait plane. La ligne qui sépare la tête de la nuque forme une légère saillie au milieu, et se dirige ensuite obliquement en arrière et un peu vers les côtés pour atteindre le surscapulaire. Le bord supérieur de l'orbite est à fleur du front. La tête est plus fortement comprimée vers le bas que vers le haut; le museau est arrondi vers les côtés, en général un peu conique, et terminé par la partie antérieure de l'intermaxillaire, qui occupe le premier sixième de sa longueur. La bouche étant très-fendue, le bord postérieur du maxillaire s'étend jusque sous l'aplomb du diamètre vertical de l'oeil. La ligne de la bouche forme avec l'axe longitudinal du corps un angle d'environ quarante degrés. Le bord de l'intermaxillaire est evasé par devant pour se prolonger de chaque côté en un feston assez large et saillant, auquel répond une profonde échancrure de la mâchoire inférieur; cette mâchaoire dépasse un peu la supérieure et est par devant un peu courbée vers le haut. Le bord antérieur du maxillaire supérieur est un peu évasé et se loge dans l'échancrure formée au dessus du feston de l'intermaxillaire. Les sous-orbitaires forment une bande continue, dont la largeur égale deux tiers du diamètre de l'oeil. Le préopercule forme un angle droit, et l'opercule est arrondi au bord. Les téguments de la tête présentent, comme à l'ordinaire, une surface unie. La ligne latérale occupe, comme dans les espèces précédentes, le quart inférieur du corps du poisson, et elle monte par devant, en faisant une courbe assez régulière,pour se perdre sous le bord des os supérieurs du bras. Les écailles sont de grandeur moyenne; leur surface est couverte de stries divergentes, clair-semées et très-peu apparentes, et leur partie libre forme un angle obtus et arrondi; on en compte environ 50 sur la ligne latérale, et entre le dos et le ventre 20 rangées, dont 11 au dessus de la ligne latérale. L'anus

* TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poisson, pp. 211-213.

s'ouvre immédiatement en avant de l'anale, sur le commencement du troisième tiers de la distance comprise entre l'extrémité du museau et la base de la caudale.

Les pectorales naissent sur la ligne du bord inférieur du préopercule; leur longueur est un peu moindre que celle de la tête sans le museau, et elles se prolongent en une pointe, distante de la base des ventrales à un intervalle surpassant le tiers de leur longueur. Les ventrales, d'un tiers plus courtes que les ventrales, ont leur pointe éloignée de l'anus à une distance égale à la moitié de leur longueur. L'anale offre une forme assez régulière; son bord inférieur est presque droit; elle est par derrière de presque deux tiers plus basse que par devant; des trois rayons indivisés et flexibles qui la précèdent, le troisième égale en longueur le premier rayon mou, le deuxième est de moitie de la longueur du troisieme et le premier est trois fois dans le deuxième; les rayons mous proprement dits de cette nageoire sont tous divisés à leur moitié terminale en deux branches séparées par une petite membrane. La caudale est profondément échancrée et par conséquent divisée en deux lobes qui sont d'égale longueur. La dorsale nait vis à vis de la base des ventrales; elle est par derrière presque de moitie plus basse que par devant, où sa hauteur égale la longueur de la tête en arrière des yeux; des deux rayons indivisés et flexibles dont elle est précédée, le premier est de moitié plus court que le deuxième qui se prolonge jusqu'au point le plus élevé de la nageoire. D. 2+7; A. 3+9; V. 1+8; Pl. 15; C. 19.

Les individus conservés dans l'esprit de vin sont d'un blanc argenté très-vif; le quart supérieur du poisson est d'un brun rougeâtre. Les nageoires sont d'un jaunâtre très-pâle, avec des traces à peine apparentes d'une teinte plus foncée sur la dorsale et la caudale. Les écailles de la partie foncée du dos sont finement pointillées de noirâtre.

Description: Head $3\,^{3}/_{5}$; depth $3\,^{3}/_{4}$; D. III, 7; A. III, 9; P. I, 16; V. 9. Scales 50 in the lateral line; 10 scales between the origin of the dorsal fin and the lateral line, and 5 between the latter and the middle of belly; pharyngeal teeth 5, 4, 2–2, 4, 5; width of head $2\,^{1}/_{6}$ in its length; snout $3\,^{1}/_{3}$ in head; eye 7; interorbital space $3\,^{1}/_{4}$, pectoral $1\,^{1}/_{4}$, ventral $1\,^{3}/_{4}$; eye 2 in snout.

Body rather elongated, oblong, and strongly compressed. Head moderately large, rather pointed, greatly compressed, flattened on the sides, with curved concaved profile; sides of snout rounded, and the tip blunt and truncated; eye moderately large, anterior and superior; interorbital space rather broad, nearly flat; nostrils two, close together near anterior margin of eye; snout rather long, bluntly pointed, its length 2. 45 times of eye diameter; mouth large, very oblique; maxillary reaching the anterior margin of the eye, protractile, ensheathed above, and with a deep notch along the sides into which the rami of the mandible fit; lower jaw much the longer, projecting, and the symphysis fitted into a notch in the upper jaw; pharyngeal teeth 3-rowed, 5, 4, 2–2, 4, 5, outer ones enlarged, pointed, slightly hooked, without grinding surfaces, and about a half an eye diameter distant from the upper front of the eye; interorbital space and top of the head broad and flattened, the former very slightly elevated. No barbels. Gills 4; a large slit behind the fourth; pseudbranchiae present; gill openings very wide, continued foreward below; the membranes narrowly united to the isthmus after continuing a short distance foreward beneath; gill rakers 3 + 9, short and firm. Intestine with few turns, short. Peritoneum pale or silvery. Scales large, cycloid, and more or less narrowly imbricated; pectoral fin flap short and fleshy; ventral fins with a scaly flap at the base. Head scaleless; lateral line complete, rather low, decurved, concurrent with the outline of the belly, ending at the base of the caudal fin. Origin of dorsal fin midway between the tip of the snout and the base of the caudal fin, when depressed,

reaching beyond the origin of the anal fin, the base of the fin $2\,^1/_3$ in head and its upper edge straight; origin of anal fin a little nearer the base of the caudal fin than the middle of the pectoral fin, and the base of the fin $1\,^2/_3$ in head; caudal fin deeply emarginate, and the lobes pointed; pectoral fins long, four fifths the distance to the origin of the ventral fin below that of the dorsal fin and reaching to within a short distance of the origin of the anal fin. Caudal peduncle $1\,^3/_5$ in head, and least depth 3 in head. Lateral line continuous, inferior, and running along to lower part of the caudal peduncle.

Table 78. Measurements of *Opsariichthys uncirostris* (TEMMINCK et SCHLEGEL).

No.	Total length	Body length	No. of vertebrae	$\frac{\text{B.L.}}{\text{B.L.}}$	$\frac{\text{B.L.}}{\text{H.L.}}$	$\frac{\text{H.L.}}{\text{S.L.}}$	$\frac{\text{H.L.}}{\text{E.D.}}$	$\frac{\text{H.L.}}{\text{C.L.}}$	$\frac{\text{C.L.}}{\text{C.H.}}$
11.	270mm.	216mm.	—	4. 1	3. 5	2. 9	6. 7	1. 9	1. 5
12.	273	221	41	4. 2	3. 5	3. 1	6. 7	2. 0	1. 6
13.	295	240	41	4. 5	3. 6	2. 9	6. 7	1. 9	1. 6

B.=Body, L.=Length, D.=Depth, H.=Height, C.=Caudal.

*The measurements made by K. UCHIDA for the specimens of Lake Biwa in September, 1936.

Secondary sexual characters: The dorsal and anal fin of the male are longer than those of the female. The anterior soft rays of the anal fin of the male are very long and projected. The pectoral and anal fins of the female are shorter than those of the male. In the male, the pearl organs appear on the snout, upper and lower jaws, around the orbit, preopercle, caudal and anal fins, and on the caudal. In the breeding season, the male shows a beautiful purplish green and a reddish orange stripe along the lateral line, and belly. The upper and lower jaws and the lower margin opercle also show reddish yellow. Eyelid is deep bluish green, margined with orange red color and the soft rays of dorsal, ventral and anal fins are yellow and those membrane deep red. The pectoral fin is deeply orange red.

Color in alcohol dark brown above, the lower portions of the body pale; dorsal with membranes between the rays and the tips of the posterior rays grayish black, the rest of the fin paler; anal and caudal fins more or less greyish; pectoral and ventral fins pale. Male with rosy shades in life. Sometimes many blackish points on the head, body and the fins due to infection by parasites. Color in fresh specimens, the ground color of the body dark yellowish, with silvery white belly. The dorsal side of the head dark gray, the lateral area light yellow. The young are more bluish on the back than the adult.

Y. OKADA noticed that the present species has no distinct nuptial tubercles on tip of the snout as do the species of the genus *Zacco* species. This resemblance confirms other evidence indicates that these two genera may be more closely related than other genera phylogenetically.

Habits: The present species are found in Lake Biwa, Lake Mikata in natural but transplanted into other waters. They are mostly dwelling in the water surface of Lake

Biwa, feeding on small fishes and insects. They are depositing eggs on the sandy or pebble bottoms of rivers during June and August. The fish mature in two years. In Lake Biwa, the breeding season occurs in May and June. They swim very actively and like to catch small freshwater fishes. From the end of autumn to winter, they live in the bottom of the lake and when the spring comes, they close to the shallow coast. In the breeding season, they ascend into rivers from the lake for spawning.

Table 79. Measurements of *Opsariichthys uncirostris* (TEMMINCK et SCHLEGEL).

Collection	Fish. Mie Univ.*			
Total length	287. 0mm.	330. 5mm.	225. 5mm.	191. 0mm.
Body length	227. 0	228. 0	187. 0	157. 7
Body length/Head	3. 50	3. 61	3. 37	3. 46
Body length/Depth	4. 15	4. 22	4. 35	4. 80
Body length/Predorsal length	1. 89	1. 97	2. 02	2. 00
Body length/Prepectoral length	3. 72	4. 07	4. 00	3. 64
Body length/Preventral length	1. 89	1. 91	2. 00	1. 97
Body length/Preanal length	1. 36	1. 38	1. 39	1. 42
Head/Snout	2. 78	2. 81	2. 88	2. 99
Head/Upper jaw	1. 91	1. 92	2. 18	2. 29
Head/Interorbital width	3. 29	3. 33	3. 70	3. 66
Head/Diameter of Eye	6. 52	6. 45	6. 17	5. 85
Head/Length of Caudal peduncle	1. 67	1. 62	1. 81	1. 56
Head/Depth of Caudal peduncle	3. 13	3. 21	3. 39	3. 44
Head/Length of Dorsal fin	2. 62	2. 77	2. 75	2. 95
Head/Length of Anal fin	2. 17	2. 34	2. 44	2. 43
Head/Heigth of Dorsal fin	1. 64	1. 70	2. 00	1. 78
Head/Heigth of Anal fin	1. 10	1. 34	1. 52	1. 42
Head/Pectoral length	1. 34	1. 53	1. 64	1. 69
Head/Ventral length	1. 97	2. 14	2. 38	2. 25
Date	IV, 1953			
Locality	Lake Biwa, Shiga Prefecture			

*Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

Remarks: The present species is allied to *Opsariichthys bidens* GUNTHER found in Northern China, Manchuria, and Korea.

Type Locality: near Nagasaki.

Distribution: Lake Biwa (SAUVAGE); Nagahama, Matsubara Lake Biwa, (ISHIKAWA); Lake Biwa (JORDAN & SNYDER); Lake Biwa, Matsubara; Lake Yogo, Mino, River Yodo, Ôsaka; Karasaki; Lake Biwa (OTAKI); Ôtsu, Lake Biwa (JORDAN & KAWAMURA); Ôtsu (ABBOTT); Lake Biwa (MIYADI); River Hasu, Lake Mikata Fukui Pref., Lake Biwa (OKADA, MATSUBARA & UCHIDA); Hyôgo Pref.; Shiga Pref.; Lake Mikata (OKADA & MATSUBARA); River Yodo; Lake Biwa; Lake Mikata, Fukui Pref. (OKADA & NAKAMURA); Lake Biwa; Lake Yodo?; Nagasaki; River Yodo at Ôsaka (JORDAN, TANAKA, SNYDER); Hachi Fukui (JORDAN & HUBBS); Lake Biwa; Kasumigaura (EBINA). Lake Biwa; River Yodo (TANAKA; MATSUURA); Ogura Pond (MATSUURA, AOYAGI); Lake Yogo, Shiga Prefecture (KOBAYASHI); River Hasu, Lake Mikata; Fukui Prefecture (JORDAN, HUBBS, TANAKA); Nagasaki Prefecture (TEMMINCK, SCHLEGEL).

74. Hemigrammocypris rasborella FOWLER.

"Kawabata-moroko"

(PL. XXXVI, figs. 1–4)

Hemigrammocypris rasborella FOWLER, 1910, Proc. Acad. Nat. Sc. Phil. pp. 484-486, fig. 4. – JORDAN et HUBBS, 1925, Mem. Carn. Mus. vol. X, no. 2, p. 161, pp. 189-190. – MIYADI, 1935, Kyôto Fuka no Tansuigyorui, Kyôtofu Shiseki Meisho Tennenkinenbutsu Tyôsa Hokoku, vol. 16, p. 34. – OKADA, 1938, Cat. Vert. Japan, p. 146. – OKADA et NAKAMURA, 1950, Nihon no Tansuigyorui, p. 175, fig. 100.

The original description* is as follows:

Hemigrammocypris rasborella FOWLER

Head $3\,^1/_4$; depth 3; D. III, 7, I; A. III, 8, I; P. I. 11; V. 1, 6; scales in lateral series to caudal base 32+2; 12 scales transversely, between dorsal and anal origins; 13 predorsal scales; head with 2 in its length; head depth at occiput $1\,^2/_5$; first branched dorsal ray $1\,^3/_7$; first branched anal ray 1 4–5; least depth caudal peduncle $2\,^1/_2$; pectoral $1\,^5/_7$; ventral $1\,^3/_4$; snout 4 in head measured from upper jaw tip; eye $3\,^1/_2$; maxillary 3; interorbital 3.

Body compressed, moderately deep, rather ellipsoid greatest depth at dorsal origin, post ventral trenchant and other edges convexly rounded. Caudal peduncle compressed, least depth $1\,^1/_3$ its length.

Head compressed, moderate, flattened sides slightly converging below, upper profile nearly straight and less inclined than lower, which forms an angle at mandibular articulation. Snout convex over surface, upper profile straight, and length about $^3/_4$ its width. Eye circular, moderate, a little high, and center near first third in head. Mouth moderate, well inclined. Premaxillaries protractile anteriorly down. Lips firm, scarcely distinct from jaws. Maxillary well inclined to hind nostril. Mandible prominent, depressed, protruding beyond snout tip, moderate, and rami a little elevated inside mouth. Tongue fleshy, not free. Jaw edges firm, scarcely trenchant and laterally on each side of upper a broad notch. Nostrils large, together, anterior circular with rather broad posterior cutaneous margin exposing posterior in narrow cresent. Interorbital broadly and evely convex. Preorbital moderate, trapezoidal, length $1\,^1/_3$ in eye. Postorbital width $2\,^1/_3$ in eye, and infra-orbitals Scarcely more. Posterior preopercle margin vertical, or sloping but slightly backwards below.

Gill-opening forward nearly midway in head, not quite to hind eye margin. Rakers about 2 8? firm points, about 4 in filaments, and latter about $1\,^2/_5$ in eye. Pseudobranchiae a little less than filaments. Teeth 1, 3, 5–5, 3, 1, ends hooked, and larger with slight smooth grinding-surfaces, edges also smooth.

Scales large, narrowly imbricated, on sides of body, disposed in even longitudinal series, and smaller on edges of body and breast. Axillary ventral scale short, little pointed, mostly adnate. L. l. decurved slightly below lowest third in greatest body depth, incomplete, and only extending opposite ventral base. Tubes short, each over about first $^2/_3$ expossed scales, simple and 12 in number.

Dorsal origin nearly midway between hind pupil margin and caudal base, first branched ray longest, depressed fin $1\,^5/_6$ caudal base. Anal inserted just behind dorsal base, fin similar, depressed $1\,^1/_2$ to caudal base. Caudal base. Caudal emarginate, lobes equal, little pointed. Pectoral $^3/_4$ to ventral, upper rays longest. Ventral inserted a little before dorsal nearly midway between tip of muscle and caudal base. Vent simple, close before anal.

Color in alcohol generally dull brownish, a little paper below. Back and upper surface of head sprinkled with minute dusky dots, becoming a little more sparse and larger on opercle and longitudinally, along middle of side, most pronounced superiorly. Concurrent with vertebral column a dusky streak, diffuse largely, and becoming more distinct and emphasizeda long caudal peduncle side, but fading out at pale caudal base. Fins all pale brownish, dorsal, caudal and upper pectoral rays all

* Proc. Acad. Nat. Sc. Philadelphia, pp. 484-486, fig. 4.

prinkled with minute dull dusky dots. Snout pale dusky. Lips pale. Iris whitish. Length $2^{1}/_{16}$ inches.

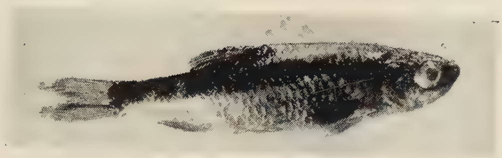
Type, No. 29,1 62, A. N. S. P. Lake Biwa at Matsubara in Ômi, Japan. JORDAN and SNYDER. From Stanford University.

A large number of small examples, with the same date, were received with the other small cyprinoids some years ago.

Description: Head $3^{1}/_{4}$; depth 3; D. III, 7, I; A. III, 8, I; P. I. 11; V. I, 6. Scales in lateral series to caudal base 32+2; 12 scales transversely between dorsal and anal origins; 13 predorsal scales; head with 2 in its length; head depth at occiput $1^{2}/_{5}$; first branched dorsal ray $1^{3}/_{7}$; first branched anal ray 1 4–5 least depth caudal peduncle $2^{1}/_{2}$; pectoral $1^{5}/_{7}$; ventral $1^{3}/_{4}$; snout 4 in head measured from upper jaw tip; eye $3^{1}/_{2}$; maxillae 3; interorbital 3. Body oblong, elongated, slightly compressed, greatest depth at dorsal origin, with nape somewhat elevated, with a sharp, thin projecting edge between anal and ventral fins, before which the belly is broadly rounded transversely; ventral profile rather strongly curved; caudal peduncle long, least $1^{1}/_{3}$ its length, compressed. Head moderately large, compressed, sides flattened slightly with nearly straight profile, eye circular, lateral, a little high up; interorbital broad, gently convex; snout convex, short, pointed; nostrils large, double very close together, directly in front of eye, the anterior circular with rather broad posterior cutaneous margin exposing posterior in narrow crescent; maxillae entirely concealed by preorbital, not reaching to beneath the front margin of the eye; mandible prominent, despressed, protruding beyond snout tip, moderate. Mouth moderate, well inclined, terminal, with lateral cleft; no barbels or papillae about mouth; gill openings large, nearly midway in head, continued downward and forward; the membranes broadly joined to the isthmus; gills 4; a large slit behind the fourth; small pseudobranchiae present, a little less than filaments; pharyngeal teeth 3 rowed, 4, 4, 2-2, 4, 4, hooked, edge smooth, color pale, sometimes with brownish tip. Dorsal fin inserted nearly midway between the posterior margin of the pupil and the base of the caudal fin, caudal entirely behind dorsal; the anterior most ray of both fins rudimentary and not spinous; pectoral fins low down, pointed but not falcate; ventral fins inserted entirely behind posterior tip of pectoral and slightly before vertical through origin of the dorsal fin, not reaching to vent which is situated directly in front of anal fin; caudal fin deeply emarginate lobes equal, slightly pointed. Scales large, cyloid, rather narrowly imbricated, on sides of body, disposed in even longitudinal series, head entirely naked, lateral line decurved, incomplete, ending on the 21 scales as counted backward from the anteriormost one; about 16 scales present on midback between the nape and the origin of the dorsal fin.

Secondary sexual characters: The color is different in both sexes. In the female, the body is ligth greenish brown while in the male it shows a beautiful golden colour. A dark brown stripe runs from the posterior margin of the opercle to the end of caudal peduncle along the mid-lateral line in both sexes. The brown longitudinal line also runs along the midline of the back.

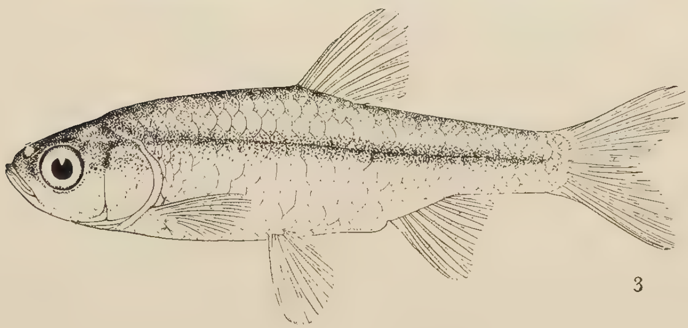
Color in formalin light brown, sides and under parts pale; a dark brown longitudinal band, very slightly curved dorsal, runs near back from anterior part of body directly



1



2



3



4

1. ***Hemigramocypris rasborella*** FOWLFR, Lake Biwa. ♂
2. ***Hemigramocypris rasborella*** FOWLER, Lake Biwa. ♀
3. ***Hemigramocypris rasborella*** FOWLER. ♂ ×2.5
4. ***Hemigramocypris rasborella*** FOWLER. ♀ ×2

behind head to near base of caudal, another band along midback from nape to base of caudal, all the fins except dorsal pale; dorsal, caudal and upper pectoral rays all sprinkled with minute dull dusky dots, iris whitish. Snout pale dusky; lips pale.

Habits: Breeding habit is unknown. The fish likes to gather in the steady shallow water of the lakes and rivers where weeds are densely planted on mud-sandy bottoms. Mostly they are swimming in the upper middle layer of water in a small group.

Remarks: OKADA and NAKAMURA mentioned in their book entitled "Nihon no Tansuigyorui" that the present species lives in lake, swamp, reservoir and canal, swimming together with *Oryzias latipes* and *Pseudorasbora parva*. This is omnivorous.

The breeding occurs during June and July. The eggs are deposited on water plants along the river sides. The eggs measured 1.00 mm., in diameter, the smallest eggs of all the Japanese cyprinoids.

Table 80. Measurements of *Hemigrammocypris rasborella* FOWLER.

Collection	O. H. B. S.*	
Total length	45. 0 mm.	42. 0 mm.
Body length	38. 00	35. 0
Body length/Head	3. 45	3. 18
Body length/Depth	3. 45	3. 50
Body length/Predorsal length	1. 81	1. 75
Body length/Prepectoral length	3. 45	5. 50
Body length/Preventral length	2. 12	2. 06
Body length/Preanal length	1. 46	1. 40
Head/Snout	3. 66	4. 40
Head/Upper jaw	2. 20	2. 75
Head/Interorbital width	3. 66	3. 67
Head/Diameter of Eye	2. 76	3. 67
Head/Length of Caudal peduncle	1. 10	1. 22
Head/Depth of Caudal peduncle	2. 76	3. 67
Head/Length of Dorsal fin	1. 84	2. 20
Head/Length of Anal fin	2. 76	3. 67
Head/Height of Dorsal fin	1. 22	1. 38
Head/Height of Anal fin	1. 84	2. 20
Head/Pectoral length	1. 57	1. 84
Head/Ventral length	1. 84	2. 20
Date	IV, 1927	
Locality	Lake Biwa, Shiga Prefecture	

*Ôtsu Hydrobiological Station attached to Kyôto University.

Distribution: River Kachi at Nagoya (JORDAN); Lake Biwa at Otsu (TANAKA) Western part of the middle of Honshû, along the inland seaside of Shikokû and Kyushû, the eastern limit is River Oi, Shizuoka Prefecture (OKADA & NAKAMURA); River Yodo (MIYADI). Lake Biwa (FOWLER, TANAKA, JORDAN, HUBBS, AOYAGI); Tsu, Mie Prefecture (TANAKA); River Kiso (JORDAN, HUBBS; NIWA). Tsuyama, Okayama Prefecture (MIYADI).

Genus **Ischikauia** JORDAN et SNYDER, 1900.

Ischikauia JORDAN et SNYDER, 1900, Proc. U. S. Nat., Mus. p. 346.

Type: **Ichikauia steenackeri**

Characters: Body elongated, compressed and deep. Head small, compressed, the upper profile nearly straight; snout and eye about equal, the latter about in the middle of the depth of the head; mouth very oblique, the maxillae protractile and reaching the nostril; no barbel; teeth 5, 4, 2–2, 4, 5; interorbital space convex. Gill-rakers short and weak, about 4 + 9. Intestine short. Peritoneum silvery. Scales small, cycloid, about 70. Origin of dorsal fin midway between tip of the snout and the base of the caudal fin first developed ray of dorsal stiffened, spine-like; and inserted behind the tip of the depressed dorsal, its base long, 15 dveeloped rays; caudal deeply emarginate, the lobes pointed; ventral inserted below origin of dorsal. Lateral line greatly decurved and concurrent with the lower profile of the body to the caudal. Size large, color dusky.

This genus seems to be allied to the Chinese genus *Xenocypris*, differing in the smaller number of teeth (named for CHIYOMATSU ISHIKAWA, director of the Imperial Museum at Tokyô, who first sent us the species from Lake Biwa).

75. Ischikauia steenackeri (SAUVAGE).

Cotton-Thing, "Wataka, Umauo"

(PL. XXXVII, figs. 1–3)

Opsariichthys steenackeri SAUVAGE, 1883, Bull. Soc. Philom., Poiss., p. 148.

Ischikauia steenackeri ISHIKAWA, 1895, Zool. Mag. (Tokyô), p. 129. – JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., p. 346, Pl. 10. – JORDAN, TANAKA & SNYDER, 1913, Cat. Fishes Japan, p. 63. – JORDAN & THOMPSON, 1914, Mem. Carn. Mus., vol. vi, p. 233. – TANAKA, 1921, Nihon Gyogaku, p. 194. – JORDAN & HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, p. 189. – MIYADI, 1928, Kyôto Fukano Tansuigyo, pp. 33–34. – OKADA, MATSUBARA & UCHIDA, 1935, Nihon Gyorui Zusetsu, p. 85, pl. 30, fig. 3. – OKADA et NAKAMURA, 1948, Nihon no Tansui Gyorui, pp. 174–176, fig. 99.

Ischikavia steenackeri JORDAN et SNYDER, 1901, Fish. Japan, p. 48. "Genus? species? WADAKA", Zool. Mag., 1895, p. 129.

Type Locality: Lake Biwa.

The original description* is as follows:

Opsariichthys steenackeri SAUVAGE, 1883

D. 9; A. 17; L. lat. 75.

Corps allongé, semblable à celui du *Squalibarbus curriculus*; hauteur contenue cinq fois, longueur de la tête cinq fois et demie dans la longueur totale. Museau aussi long que l'oeil, dont le diamètre est contenu quatre fois dans la longueur de la tête; pas de barbillons; mâchoire supérieure recouvrant légèrement inférieure; dents pharyngiennes 5, 4, 2, uncinées, calles de la rangée intermediaire créneleees au sommet. Dorsale insérée à égale distance de l'extrémité du museau et de la base de la caudale, un peu en arrière de l'origine des ventrales; pectorales presque aussi longues que la tête; ventrales insérées un peu plus pres des pectorales que de l'anale. Ligne latérale recourbée. Péritoine noir. Longueur, 0,330.

Nom vulgaire: Masou; Ida.

* Bulletin de la Société Philomathique de Paris, Septiéme Série – Tome Septiéme, p. 148.

Description: Head 5; depth $3\,^5/_6$; D, III, 7; A. III, 15; P. 17; V. 9; scales 70 in the lateral line; 12 scales between the origin of the dorsal fin and the lateral line, and 7 between the latter and the middle of the belly; pharyngeal teeth 5, 4, 2 -2, 4, 5; width of head $1\,^2/_3$ in its length; snout 4 in head; eye 4; interorbital space $2\,^2/_3$; pectoral fin about $1\,^1/_8$; ventral fin $^1/_3$.

Body elongate, compressed and deep. Head small, compressed, and the upper profile nearly straight; snout about equal to eye, bluntly pointed; eye large, anterior, and nearly in the middle of the depth of the head; mouth very oblique, the jaws nearly equal, the maxillary protractile and extending below the nostril; lips fleshy; pharyngeal teeth compressed, and those in the outher rows with a narrow grinding surface; nostrils close together on the sides of the snout and near the eye; inter-orbital space broad and convex. Opercles striated. Gill opening large; gill-rakers short, pointed, 4 + 9; pseudobranchiae present. Intestine rather short; peritoneum gray. Scales large, cycloid and uniform in size; a small pectoral flap; ventral flap present. Origin of the dorsal fin midway between the tip of the snout and the base of the caudal fin; when depressed reaching almost to the origin of the anal fin, the base of the fin $1\,^3/_4$ in its height, anal fin ventral, edge straight; inserted nearer the origin of the ventral fin than the base of the caudal fin, the base of the fin long, about equal to the length of the ventral fin, caudal fin deeply emarginate, and the lower lobe the longer; pectoral fin a little more than two-thirds to the origin of the ventral fin, ventral fin three-fifths to anal. Caudal peduncle deep, compressed, and its least depth 2 in head. Lateral line decurved, and concurrent with the lower profile of the body to the caudal.

Table 81. Measurements of *Ishikauia steenackeri* (Sauvage).

Collection	O. H. B. S.				
Total length	141.0mm.	81.0mm.	66.0mm.	73.0mm.	60.0mm.
Body length	122.0	66.7	53.0	58.0	48.0
Body length/Head	4.26	4.17	4.25	4.08	4.90
Body length/Depth	3.92	4.45	4.53	4.40	4.65
Body length/Predorsal length	2.00	2.30	2.28	2.19	2.09
Body length/Prepectoral length	4.24	4.38	4.08	4.05	3.84
Body length/Preventral length	2.02	2.30	2.21	2.13	2.30
Body length/Preanal length	1.37	1.52	1.47	1.49	1.52
Head/Snout	4.20	4.00	3.79	3.56	3.06
Head/Upper jaw	4.28	4.57	4.17	4.05	3.50
Head/Interorbital width	3.19	3.55	3.13	2.96	2.58
Head/Diameter of Eye	3.59	3.48	2.98	3.03	2.45
Head/Length of Caudal peduncle	1.42	1.50	1.28	1.32	1.09
Head/Depth of Caudal peduncle	2.05	2.39	2.27	2.59	2.04
Head/Length of Dorsal fin	2.45	2.14	2.02	2.19	1.69
Head/Length of Anal fin	1.62	1.52	1.39	1.39	1.23
Head/Height of Dorsal fin	1.16	1.14	0.99	0.98	0.91
Head/Height of Anal fin	1.97	1.78	1.56	1.58	1.64
Head/Pectoral length	1.22	1.43	1.28	1.29	1.09
Head/Ventral length	1.45	1.53	1.25	1.45	1.15
Date	II, 1915				
Locality	Zeze, Shiga Prefecture				

In the breeding season, the male has pearl organs* on the internasal space, interorbital space, and around the eyes. They appear in a relatively late stage of body growth, minimum length of 112 mm. and 176 mm. maximum. size.

Color in alcohol, dark brown above, below silvery or whitish; dorsal and caudal brownish; pectorals tinted with brown, the other fins pale; edge of each scale upon the sides and upper surface with a dark spot. Length 12 inches. Color of a fresh specimen: ground color ligth yellow, lighter on the ventral margin, white on the belly ligth dark gray on the back, small black spots near the anterior margin of every scale. Face light yellow; eye light yellow except eye ball, margined with black. Dorsal fin iron black, margined light black along the anterior margin. Pectoral fin light yellow, margined with some shade of grey; ventral fin light orange without black patterns. Anal fin light yellow with black lines. Caudal fin yelow, margined with black.

Remarks: JORDAN & SNYDER remarked in their paper on Fishes of Japan of 1901, that the genus named for Prof. ISHIKAWA of the Imperial Museum of Tôkyô is closely allied to the Chinese genus *Xenocypris*, differing in that it has but four teeth in the main row and has the dorsal fin which has a stiff spine front inserted behind the ventral.

JORDAN et HUBBS mentioned in 1922 that the present species is abundant in Lake Biwa, reaching a length of nearly two feet and is a food-fish of importance. The flesh is, however, far inferior to that of the excellent "Hasu", with which it is associated.

Habits: This is quite endemic species, only found in Lake Biwa and is called to live in Sarusawa pond, Nara City, transplanted from Lake Biwa in olden time. They are mostly found in shallow waters of Lake Biwa, growing many weeds and not row up a river. In the winter, the fish live somewhat deep in the lake and about from April, they begin to close to the shallow waters forming a school and ascend into the rivers of the lake. They eat water plants as and sometimes take seedlings of paddy fields.

During the end of May and of June, in the rainy season, they come in the paddy-fields around the lake for spawning. Are deposited on water weeds and other plants of shallow waters of lake side or of paddy fields after the heavy rain. Eggs are light green. The number of the eggs is 50,000–120,000 in an adult.

Distribution: Lake Biwa (SAUVAGE); Lake Biwa (JORDAN & SNYDER); Ôtsu, Hikone, Nagahama, Lake Biwa (ISHIKAWA); Matsubara, Lake Biwa; Yodo River, Ôsaka (JORDAN & THOMPSON); Lake Biwa (JORDAN & HUBBS); Lake Biwa, Yamato (JORDAN & SNYDER); Lake Biwa; Noyshiro; Yodo River (JORDAN, SNYDER & TANAKA); Lake Biwa, Ôtsu (JORDAN & KAWAMURA); Ogura Pond (MATSUURA, AOYAGI).

Genus Cyprinus (ARTEDI) LINNAEUS, 1738.

Cyprinus ARTEDI, 1738, Generi.

Cyprinus LINNAEUS, 1758, Syst. Nat., ed. 10, vol. 1, p. 320, (Type, *Cyprinus carpio* LINNAEUS, Designated by JORDAN and GILBERT, Proc. U. S. Nat. Mus., vol. 16, p. 254, 1883.)

*OKADA, Y., 1934, Science Report of the Tokyô Bunrika Daigaku, Sect. B, no. 28, pp. 34–35.



1



2



3

1. ***Ischikauia steenackeri*** (SAUVAGE). ♂
2. ***Ischikauia steenackeri*** (SAUVAGE). ♀
3. ***Ischikauia steenackeri*** (SAUVAGE). $\times \frac{1}{3}$

Carpio HECKEL, Rusegger's Reise, 1843, vol. 1, p. 1014. (Type, *Carpio Kollarii* HECKEL (hybrid), designated by BLEEKER, 1883. Atlas Ichth. Ind. Neerland., vol. 3, p. 24.)

Characters: Body robust, compressed. Head moderate in size. Snout blunt, rounded.Mouth moderate, terminal. Barbels 4, long. Gill-openings wide, reach beyond hind border of preopercle. Gill-membranes broadly joined to isthmus. Pharyngeal teeth 1, 1, 3–3, 1, 1, broad, truncate, molar-like, crown furrowed, flat or concave. Scales large. Lateral line complete, extends midway along side of body. Dorsal fin very long, origin opposite ventral fin origin, front rudimentary rays spinous and last enlarged or stout and bony, its hind edges serrated. Anal fin short, its origin below hind half of dorsal fin front rudimentary rays spinous and last strongly ossified and serrated behind. Large fishes of the fresh waters of Asia, now widely introduced into various parts of the world as food fishes.

76. Cyprinus carpio LINNAEUS.

Carp, "Koi"

(PL. XXXVIII, figs. 1–7; PL. XXXIX, figs. 1–19)

Cyprinus carpio LINNAEUS, 1758, Syst. Nat., ed. 10, vol. 1, p. 320. (type locality: Europe). – GUNTHER, 1868, Cat. Fishes Brit. Mus., vol. 7, p. 25. – JORDAN et SNYDER, 1901, Fishes of Japan, p. 46. – JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., vol. 26, no. 1334, pp. 860, 862. – JORDAN et METZ, 1913, Mem. Carneg. Musea. vol. 6, no. 1, p. 14 – TANAKA, 1921, Nihon Gyogaku, p. 195 – JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Jap., p. 76 – HERRE, 1924, Proc. Pan. Pacific Sci. Congr., Australia, vol. 2, 1923, p. 1568 – JORDAN et FOWLER, 1924, Philippine Journ. Sci., vol. 25, p. 271, p. 705. – CHU, 1931, Biol. Bulletin, St. John's Univ., no. 1, pp. 63–64 – EBINA, 1931, Nihon Gyorui Zushû, pl. 37. – CHU, 1932, Fish West Lake, pp. 33–34, figs. 18, 24. – MORI, 1936, Stud. Geog. Dist. Freshwat. Fish ? East Asia, pp. 4, 7, 11, 16, 22, 25, 31, 41, 48, – ROXAS et MARTIN, 1937, Dept. Agr. Comm. Manila Tech. Bull., 6, p. 40. – CHEVY et LEMASSON, 1937, Cont. e'tude Poiss. Eaux Douces Tonk., pp. 20–23, fig. 3. – OKADA, MATSUBARA et UCHIDA, 1938, Keys Fish and Fish-like Animals Japan, p. 77. – OKADA, 1938, Cat. Vert. Japan, p. 147. – FOWLER, 1938, List Fish Malaya, p. 68. -OKADA et IKEDA, 1938 Saitô hô-on Kai Museum, Research Bull., no. 15, p. 90. – UCHIDA, 1939, Bull. Fish. Exp. Stat. Chôsen, no. 6, pp. 70–80, pl, 7, figs. 1–4; text-figs. 1–6 – FOWLER, 1941, Smith. Inst. U. S. Nat. Mus., Bulletin 100, vol, 13, pp. 776–777. – HARADA, 1943, Kainantô Tansui Gyofu, p. 15, pl. 5, fig. 12 – OKADA et NAKAMURA, 1948, Freshwater Fishes of Japan, p. 178, fig. 103. – KAMOHARA, 1950, Desct. Fish. Prov. Tosa and Kishû, p. 46. – SUEHIRO, 1951, Text-book of Ichthyology, pp. 293–295, fig. 195.

Cyprinus haematopterus SCHLEGEL, 1886, Fauna Japonica Poiss., p. 189, pl. 96, fig. 2.

Cyprinus melanotus SCHLEGEL, 1886, Fauna Japonica Poiss., 190, pl. 97, fig. 1.

The original description is as follows:

Cyprinus carpio LINNAEUS, 1758

Tomus I, p. 321

Cyprinus. Caput ore edentuto; Os nasale bisulcum. Membr. branch. radiis., III., Corpus laeve, albens. Pinnae ventrales saepe novemradiatae.

* LINNAEUS, C., Systema Naturae 1758, Tomus I, p. 321.

Barbus. 1. C. pinna ani radiis 7, cirris 4, pinnae dorsi radio secundo utrnique serrato. D. $^2/_{11}$, P. 16, V. 9, A. 7, C. 16.

Art. gen. 4. syn. 8. Cyprinus maxilla superiore longiore, cirris 4, pinna ani ossiculorum 7. Gron. mus. 1. n. 20, idem. D. $^3/_{12}$, P. 16, V. 9, A. 7, C. 16, mus. 2. p. 3. idem. D. 10, P. 17, V. 9. A. 8, C. 17. Habitat in Europa australi. Ova choleram causantur. Fin. cas. 104.

Carpio. 2. C. pinna ani radiis 8, cirris 4, pinnae dorsalis radio secundo postice serrato. D. $^2/_{24}$, P. 16, V. 9, A. 9, C. 19.

Art. gen. 4. syn. 3. spec. 25. Cyprinus cirris 4, ossiculo tertio pinnarum dorsi anique uncimelis armato. D. 24, P. 16, V. 9, A. 9, C. 19. Fn. svec. 317, idem. Gron. mus. 1, n. 19, idem. D. 23, P. 17, V. 8, A. 8, C.·········

Habitat in Europa. Nobilis piscis saepius in piscinis educatus, circa a. 1600 primum in Angliam introductus.

Description: Depth $2\,^2/_5$ to $2\,^3/_5$; head $2\,^7/_8$ to $3\,^1/_8$, width $1\,^2/_5$ to $1\,^3/_5$, naked, snout $2\,^1/_2$ to 3 in head; eye 5 to $5\,^1/_4$, $1\,^7/_8$ to 2 in snout, $1\,^3/_4$ to $2\,^1/_4$ in interorbital; margin of upper jaw formed by the premaxillaries alone; lower pharyngeal bones well-developed, nearly parallel with the gill arches, each provided with 1 to 3 series of teeth, few in number, 1, 1, 3+3, 1, 1, robust, molar like, with crowns flattened or somewhat furrowed; maxillary raeaches $^4/_5$ to $^7/_8$ to eye, length 3 to $3\,^1/_3$ in head; barbels 2 or 4; front barbel from 3 to equal to the eye, hind barbel 5 to $5\,^4/_5$ in head; lower jaw included in upper; interorbital $2\,^3/_5$ to $2\,^3/_4$, broadly convex; suborbitals cover about $^1/_3$ to cheek to preopercle ridge. Gills 4, a slit behind the fourth; gill rakers 4–13, lanceolate, $^1/_3$ of gill-filaments, 4 in head. Pseudobranchiae usually present.

Scales large and rather thick, 30 to 32 in a lateral line to the caudal base and 3 more on the latter; 6 above, 5 below, 11 to 13 predorsal, 16 around caudal peduncle. Scales with 24 basal and 67 apical radiating striae; circuli finely concentric, imperfect apically.

Dorsal fin short or elongate; D. IV, 19, 1 to 21, 1, fourth spine enlarged, osseous, hind edges with upper half at least strongly serrate, first branched ray $1\,^2/_3$ to $1\,^3/_4$; least depth of caudal peduncle 2 to $2\,^1/_3$ hind edges strongly serrated terminally; pectoral not reaching ventrals, $1\,^2/_5$ to $1\,^1/_2$; ventral $1\,^1/_2$ to $1\,^4/_5$; caudal moderately forked, $2\,^3/_4$ to $3\,^1/_5$ in rest of body, well-forked, lobes pointed. Air-bladder usually large, commonly divided into an anterior and posterior lobes, not inclosed in a bony capsule, rarely wanting. Stomach without appendages, appearing as a simple enlargement of the intestines.

Above olive-brown, under surfaces pale to whitish. Iris pale.

Dorsal and caudal dull brownish, other fins pale to whitish. Most scales provided with black pigments on the base.

Development: Uchida made a complete description of the development of the *Cyprinus carpio.* He mentioned that the number of eggs deposited varies with the size of the female. The female of 550 mm. body length with a weight of 3500 gm. deposited about 300 to 400 thousand eggs but they are not deposited at one time. Some eggs may remain in the ovary after spawning. About 10 to 20 thousand eggs by an action and 50 to 100 thousand eggs are deposited in one time.

The optimum water temperature for spawning is 18°–22°C, determined experimentally by YAMAMOTO in 1933. Six or three-half days are required for incubation. Ist segmentation may occur in 1° 20′–40′ hours after fertilization; 2nd segmentation in 2 hours and third in $2\,^1/_2$ hours.

Morula stage in $3\,^1/_2$ hours; blastula stage in 8 hours. The embryo begins to develope in 10 hours. Blastopore closed in 18–20 hours. Ten myotomes are formed in the embryo after 24 hours and eye and Kufper's vesicle clearly observed in this stage. The embryo with 28 myotomes begins to move and just before hatching out (90 hours after fertilization) it moves freely inside egg capsule. Black chromatophores appear on the back of head, the anterior yolk sac and on the vent of body. At hatching the embryo has a body length of 5.0–5.6mm., head projected anteriorly from the anterior yolk sac. The mouth opens on the ventral side of head with undeveloped jaws. Anus situated on the posterior half of the body. Myotomes are numbered $24+12=36$. Eye situated near the tip of snout, moderately large. The dorsal fin originates from the middle dorsal part of body, narrow, extending to caudal fin, connecting with the dorsal fin. Pectoral small. Eye black; black chromatophores on the back of head and on the dorsal part of the anterior body as well as on the dorso-laterals of yolk sac. These are also distributed along the dorsal side of alimentary canal and on ventral side of tail.

The larva 3 days after hatching out (6.3 mm. in total length) with somewhat developed jaws and air-bladders near the pectorals. The back of the head and body exhibits light greenish yellow. The black chromatophores are scattered on the head and back of the body, and distributed densely along the ventral side of lateral myotomes. The large black chromatophores are scattered on the anterior lateral side of yolk sac.

Four days after hatching out, the larva absorbes the yolk sac and measures 6.5–6.8 mm. in body length. Large black chromatophores appear on the back of head and along the mid dorsal line of the body, and not on the mid-lateral side. The larva of 10.5 mm. body length is provided with $25+13=38$ myomeres, and with the caudal fin which begins to fork. Ventral fins small, pectoral fins membranous, fan-shaped. The black chromatophores appear on the lateral side of body and arranged longlitudinally on the base of caudal fin. The carp was originally a native of Asia, and from there was transplanted to Eurpoe. LINNAEUS described the European species in 1758 as *Cyprinus carpio* scientifically, but first-known mention of it as British species is in DAME JULIANA BERNER's Book of ST. ALBANS, published in 1496[1]. HERRE[2] mentioned that the carp was introduced from Hong Kong to Manila, Dulanan, Pulangi River and was planted in Lakes Dapao and Nurungan. Since its introduction, the carp has been widely distributed in the world and made many races in various countries. The mirror-carp of Germany has no enlarged scales; scales, usually reduced to one or twe series on each side, the rest of the fish being naked. *The leather carp* also occurs in Germany, entirely scaleless, provided with a thickened skin. Many different races for coloration are found

1). HERRE, 1923, Proc. Pan Pacif. Cong. Aust., vol. 12. – 1924. Philip. Journ. Sci., vol. 24.
2). REGAN, 1911, The Freshwater Fishes of the British Isles. p. 172.

in Japan. "*Irogoi*", and "*Kawarigoi*" are named for the color variations and "*Higoi*", "*Kigoi*", "*Hanagoi*", "*Madaragoi*", for pattern variations. A German carp was introduced into Japan in 1929, reported by HIGURASHI.[1)]

It was described as *Cyprinus nudus* BLOCH in 1782, and it may be a hybrid between the common carp and leather carp or mirror carp.

The Japanese carp[2)] have been cultured from ancient time; the carp from River Yodo has been reared and improved up to the present time.

The wild forms are rather rare and cultured carp are usually used for our foods.

The rearing ponds were originally made in Kôriyame District of Nara Prefecture together with the gold fish ponds. The young of the cultured carp have been needed for general demands and cultured in many ponds of Yamato and Kawachi districts. We have distinguished the cultured young from the native form by the name of "*Yamatogoi*", "*Yamatodane*" and "*Yamato*". In 1891 (*meiji*, 24), the Omi Fisheries Association introduced young carp from Koriyama, Yamato Province into Lake Biwa for propagation. From 1913 (Taishô 2), the fisheries authorities of Shiga Prefecture called the introduced young carps in Lake Biwa as "*Afumigoi*" ("*Ômigoi*") instead of "*Yamatogoi*" to distinguish them from the native forms. They are transplanted into the various prefectures as adults or young.

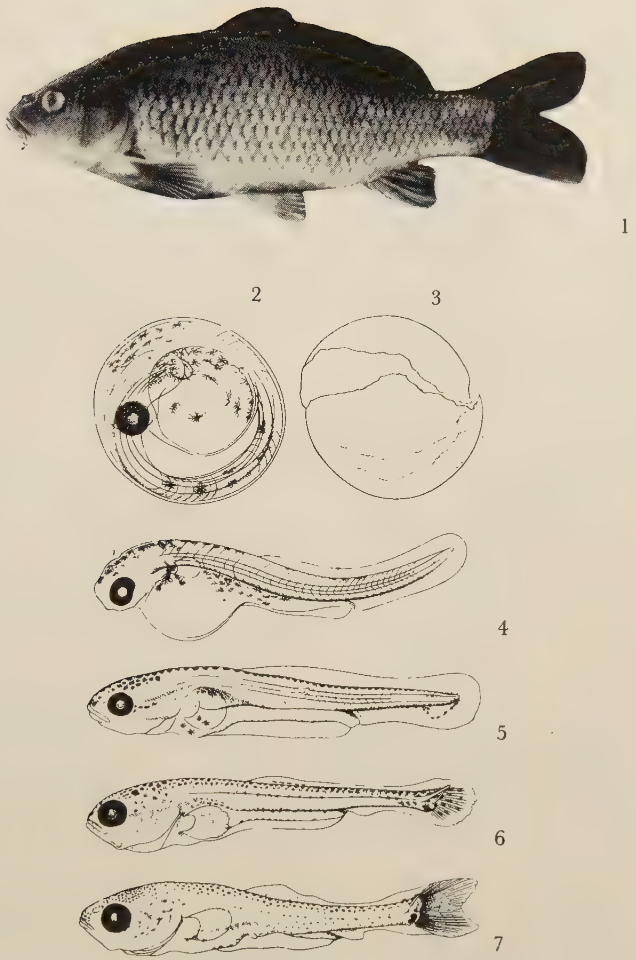
The many different names for every stage of development are: "*Kego*" or "*Mizuko*" for newly hatched larva, "*Aoko*" for young of 3 cm. in body length, one or two months after hatching, and "*Semeko*" 6–15 cm. in body length for about one year old. The rate of growth is very variable on account of the nutrition and water temperature. Carp average from I to 6 pounds, and catches of 15 pounds to 20 pounds are not rare. Weights as high as 50 pounds have been reported in U. S. America, and in Europe it grows even larger.

According to continental writers, the carp may attain the weight of nearly 100lbs, but 25 lbs seems to be about the limit for England. Carp can live for a long time out of water, and can be sent alive for considerable distances packed in damp moss; they often breath atmospheric air under normal conditions in the warm weather, coming to the surface. They have positive rheotaxis, running against water current. It is usually found in rivers, streams, and lakes having mud bottoms. In rivers and streams, it prefers the quiter streches. The breeding occurs usually in April or May, but may be prolonged throughout the summer, especially in cold weather. In this season they move into the shallow waters for spawning. The spring, or breeding dress, of the male is often peculiar; pearl organs on the cheeks and opercles, and often the fins or various portions of the body, consisting of small tubercles, out growths from the epidermis.

The eggs are deposited on the water plants, *Myriophyllum spicatum* LINN. ("Kingyoso"), *My. verticilatum* LINN. ("Fusamo"), *Ranunculus aquatilis* LINN. ("Baikamo"), *Hydrilla verticillata* CASPARY ("Kuromo") and others.

1). HIGURASHI. 1929, Yôshoku kaishi, vol. 4.
2). MATSUI, Y. 1948, Suiden Yôgyo, pp. 1-166, figs. 1-26.

PLATE XXXVIII



1. ***Cyprinus carpio*** LINN., after M. NAKAMURA.

Development of ***Cyprinus carpio*** LINN., after KEITARO UCHIDA.

2. Larva just before hatching out, the diameter of egg measured 1.83 mm.
3. Chorion after the embryo hatching out, to indicate a hatching pore.
4. Larva just hatched, 5.0mm. in total length.
5. Larva 3 days after hatched, 7.0 mm. in total length.
6. Juvenile 10 days after hatched, 8.5 mm. in total length.
7. Juvenile 15 days after hatched, 11.5 mm. in total length,

after KEITARO UCHIDA.

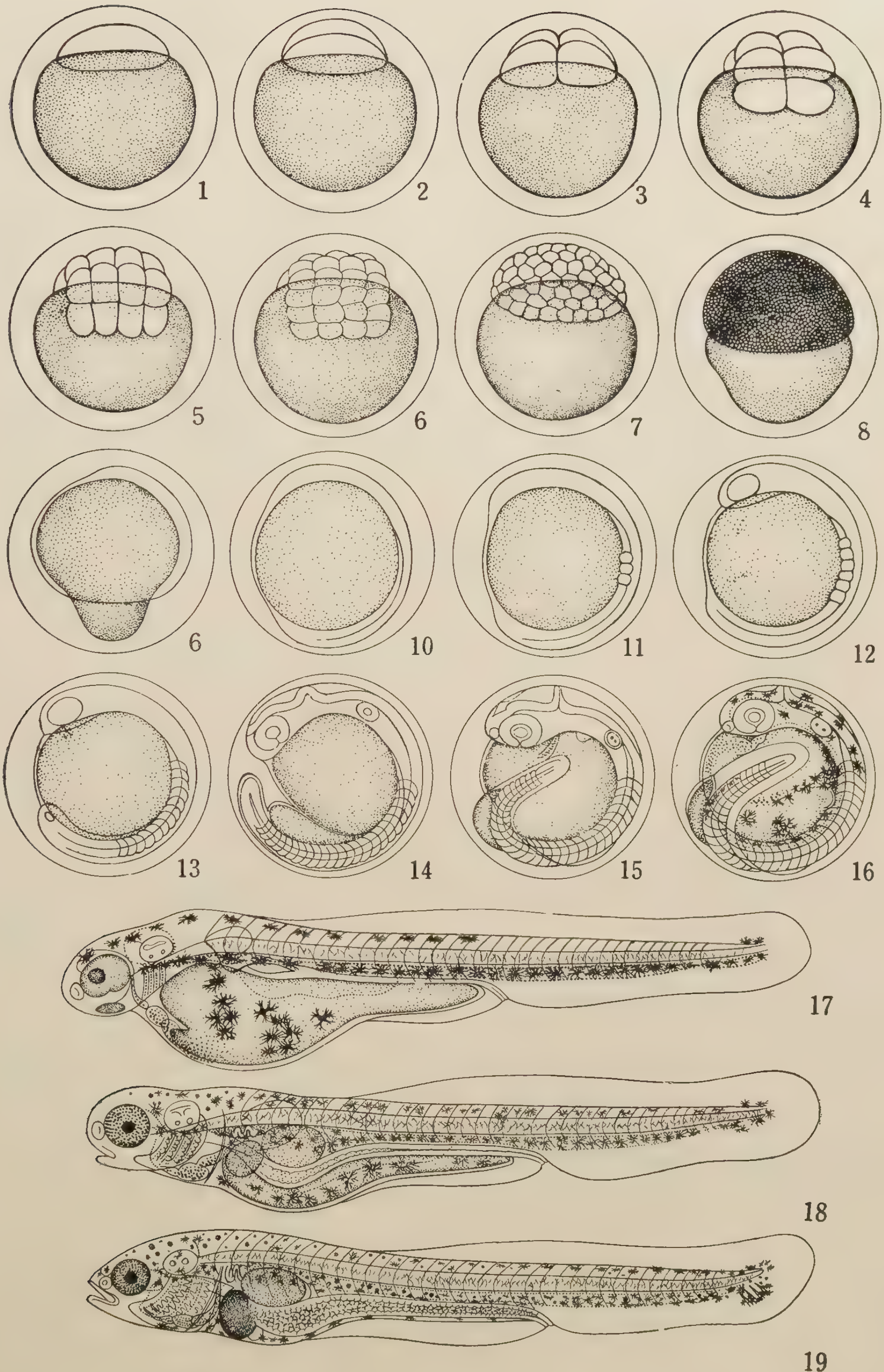
PLATE XXXIX



PLATE XXXIX

Development of ***Cyprinus carpio*** (LINNE), after TOYOJI, HIKIDA (1956).

1. Blastderm formation, 30′–1° after ovulation under water temperature arranged 12°c–25°c.
2. Two cell stage, 4°15′ after ovulation.
3. Four cell stage, 4°30′ after ovulation.
4. Eight cell stage, 5°20′ after ovulation.
5. Sixteen cell stage, 6°15′ after ovulation.
6. 32 cell stage, 10°15′ after ovulation.
7. 64 cell stage, 10°35′ after ovulation.
8. Morula stage, 34° after ovulation.
9. Gastrula stage, 38° after ovulation.
10. Embryo formation, 63° after ovulation.
11. Three myomeres on embryo, 65° after ovulation.
12. Optic vesicle formation, 80°30′ after ovulation.
13. Kupfer's vesicle 13 myomeres formation, 80°30′ after ovulation.
14. Kupfer's vesicle disappears, otocyst formation, with 25 myomeres, embryo begins to move, tail elongate, neural cord appears, 95°after ovulation.
15. Lens formation on optic vesicle; nortochord formation, melanophore on optic cup, 101°10′ after ovulation.
16. Embryo elongate; melanophores on yolk and body; blood circulation, 123°30′ after ovulation.
17. Larva just hatching, 4–5mm. in body length. 184° after ovulation.
18. Larva 3 days after hatching out, 6 mm. in body length.
19. Juvenile 7 days after hatching out, 7 mm. in body length.


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Development: The eggs are small, measuring about 2 mm. in diameter, adhesive, colorless. They hatch out in about 4 or 5 days in 20°C. water temperature. After the eggs are deposited, the parents leave them with no protection. Females are unusually prolific, and one weighting around 20 pounds will produce as many as 2,000,000 eggs in a season. Four Kgrms weight female in Japan may deposit 300,000 eggs.

The fry grow rapidly when the natural nutrition is sufficient; sexual maturity may be attained in 3 years in females and 2 years in males EBINA[1] mentioned 4 years in females and 3 years in males) when the carp may be a foot in length and weight about 1lb, but the rate of growth varies enormously according to circumstances, and the fish of this age may be 3 or 4 times as large. Growth takes place mostly the summer months. The maximum record made in Japan, is 1.53 meters in length and. 12 meters in breadth, with the weight of 45 Kgm., According to EBINA's[1] observations under natural conditions, the carp grows 180mm.～104gm. in one year; 340mm.～364gm. in second year; 380mm.～702gm. in third Year; 450mm.～988gm. in fourth year and 480mm.～1248 gm. in fifth year.

When the water temperature is raised to 12–13°C., the carp begins to breed and in 20–30°C. temperature is very active. While it prefers to feed in the mud on vegetable matter, it is really omnivorous in that it will also consume animal matter, such as worms, water insects larvae, crawfish and other small crustaceans. In the winters, the carp retire into deep water and cease feeding; they have been described as lying immovable on the mud, with their heads togethers forming a circle.

Remarks: GUNTHER[2] included *Cyprinus haematopterus* and *Cy. melanotus*, described by SCHLEGEL in Fauna Japonica from adult and half-grown specimens collected in Japan, under the present species.

KIMURA[3] also took the two species mentioned above and *Cy. conirostris* described by SCHLEGEL as well as *Cy. carp. viridiolaceus haematopterus* by SUETOVIDOV. (1933) SCHLEGEL[4] described the three species of *Cyprinus* from Japan in "Fauna Japonica". In his monograph, de VALENCIENNES described the common carp and named it *Cyprinus haematopterus*.

The second species *Cyprinus melanotus* (PL. XCVII, fig. 1,2) described from Japan, shows more slender forms than the former species and has longer pectoral fins, reaching to the base of ventrals. The third one *Cyprinus conirostris* (PL. XCVII, fig. 2) is not so elongate in form as the first species and has rather a conical pointed snout than the other species.

In 1846, JOHN RICHARDSON referred three species of Japanese carp mentioned by TEMMINCK and SCHLEGEL in their Fauna Japonica, in his paper titled on Report on the Ichthyology of the seas of China and Japan. The descriptions of these species are as follows:

1). EBINA, 1931, Nihon Zyuyo Gyorui Zushu, p. 37.
2). GUNTHER, 1868, Cat Fish. Brit. Mus., pp. 25–27.
3). KIMURA, 1934, Journ. Shanghai Sci. Inst., Sec. 3, vol. 1, p. 141.
4). TEMMINCK et SCHLEGEL, 1842, Fauna Japonica Poisson. pp. 189–192.

a). **Cyprinus (Carassius) burgeri,** TEMM. et SCHL. F. J. Sieb. Rad. D. $^3/_{15}$; A. $^3/_5$; C. $19\,^6/_5$; P. 17; V. 9.

The specimen in the British Museum is four inches long, and is named by the author of the "Fauna Japonica". It may possibly by the same with the preceding, which it resembles in outline, but it has fewer dorsal rays. There are thirty-one scales bearing tubes on the lateral line, and twelve rows in the height of the fish. It seems to have been a proper fish than the following species.

Hab. Japan.

b). **Cyprinus (Carassius) cuvieri,** TEMM. et SCHL. F. J. Sieb. Rad. D. $^3/_{18}$; A. $^3/_5$; C. $19\,^6/_5$; P. 17; A. 9.

This is much like *gibelioides*, and may prove to be the same, in which case Dr. CANTOR'S name has the priority. It seems rather more slender, and has a shorter and more delicate pectoral.
Hab. Japan.

c). **Cyprinus langsdorfii,** C. et V. XVI, p. 99.

The "Icones Piscuim 24 a pictore Sinensi" & c. include three figures which may belong to this species, if they are not referable with *gibelioides* of CANTOR. They have the lobes of the caudal and the sinus between them much more obtuse than those of *gibelioides*, or of REEVES'S figure 123, and apparently the large suborbitar of *langsdorfii*. Their lengths are 6 inches, $5\,^3/_4$ and 3 inches respectively.

Hab. Japan.

Genus Carassius NILSSON, 1832.

Carassius NILSSON, 1832, Prodr. Ichth. Scandinav., p. 32, 1832. (Type: *Cyprinus carassius* LINNAEUS, autotype).

Cyprinopsis FITZINGER, Beitr. Landesk. Oestrreich., vol. 1, p. 334, 1832. (Type: *Cyprinus auratus* LINNAEUS).

Characters: Body deeply ovoid, well-compressed. Head moderate. Snout obtuse, convex. Mouth terminal, without barbels. Gill-openings moderate. Gill-membranes widely united with isthmus. Pharyngeal teeth uniserial, 4–4, molar and compressed. Scales large, usually uniform. Lateral line complete, extends midway along side. Dorsal fin with long base, third simple ray formed as stout spine, its hind edge serrated. Anal fin much shorter, with similar stout spine. Ventral fins well forward.

77. Carassius auratus (LINNAEUS).

Crucian carp, "Funa"

(PL. XL, figs. 1–3; PL. XLI, figs. 1–7; Text-figs. 88, a–c)

Cyprinus auratus LINNAEUS, 1758, Syst. Nat., ed. 10, vol. 1, p. 323 – GÜNTHE, 1868, Cat. Fish. Brit. Mus., vol. 7, pp. 32–34.

Carassius auratus JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., vol. 23, no. 1213, p. 340. – TANAKA 1901, Fishes of Japan, p. 46 – BEAN, 1905, Proc U. S. Nat. M., vol. 28, no. 1409, p. 519, — JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Jap., p. 76. — JORDAN et METZ, 1913, Mem. Carneg. Mus., vol. 6, no. I, p. 14. — FOWLER, 1918, Copeia, no. 58, p. 62 – TANAKA, 1921, Nihon Gyogaku, p. 195 – CHU, 1932, Fish West Lake, pp. 34–35, fig. 19 – HERRE, 1931, Fishes Herre Phil-

ippine Exped., p. 20. - EBINA, 1931, Nihon Zyuyô Gyorui Zushû, pl. 38. - ROXAS et MARTIN, 1937, Dept. Agr. Comm. Manila Tech. Bull., 6, p. 41. - OKADA, 1938, Cat. Vert. Japan, p. 147. - CHEVY et LEMASSON, 1937, Cont. l'etude Poiss. Eaux Douces Tonk., pp. 24-25, fig. 5. - OKADA, MATSUBARA et UCHIDA, 1938, Keys to Fish and Fish-like Anim. Japan, p. 77. - UCHIDA, 1939, Bull. Fish. Exp. Stat. Tyôsen, no. 6, pp. 59-70, pl. 6, figs. 1-3, text-figs. 1-6. - OKADA et IKEDA, 1938, Saitô Hô-on Kai Museum Reseach Bulletin no. 15, pp. 90-91, text-fig. 2. - FOWLER, 1941, U.S. Nat. Mus., Bull. 100, vol. 13, p. 778. - HARADA, 1943, Dainantô Tansui Gyofu, pp. 16-17, pl. V, fig. 14. - SUEHIRO, 1951, Text-book of Ichthyology, pp. 295-297, fig. 296. - KAMOHARA, 1950, Descr. Fish. Prov. Tosa and Kishû, pp. 46-47.

Cyprinus burgeri RICHARDSON, 1846, Ichthy. China, p. 292.

Carassius bucephalus HECKEL, 1840, Ann. Wien. Mus., 11, p. 157.

Carassius langsdorfii SCHLEGEL, 1846, Fauna Japonica Poiss, p. 192, pl, XCVLL, fig. 1.

Carassius carassius TANAKA, 1947, Figur. and Descrp. Fish. of Japan, pp. 880-884, pl. CLXXXI, fig, 493. - CHU, 1931, Biol. Bull. St. John's Univ., no. 1, p. 64. - OKADA et NAKAMURA, 1948, Freshwater Fishes of Japan pp. 176-178, figs. 101-102.

Carassius carassius auratus langsdorfii TANAKA, 1936.

The original description* is as follows:

Carassius . 5 C. pinna ani radiis 10, caudae integra, linea laterali recta. D. 20, P. 15, V. 8, A. 9, C. 21. Fn. svec. 322, idem. Gron. mus. 1, n. 11, idem. D. 20, p. 11, V. 9, A. 10, C. 23.

Auratus, 8. C. pinna ani gemina, caudae transversa trifurca. Fn. svec. p. 125, t. Act. Stockb. 1740, p. 403. t. 1, f. 1-8, idem. D. $^{2}/_{18}$, P. 16, V. 9, A. 8, 8, C. 37. Gron. mus. 1, n. 15, idem. D. 8, P. 11, V. 7, A. ...... C. 20. mus. 2, n. 150, C. pinna ani simplici, cauda trifurca. D. 18, P. 11, V. 8, A. 8, C. 44. Habitat in Chinae, Japoniae fluviis. Piscis colitur in vasis murrbinis ob aureum fulgorem, tum multum pinnis variaus. Radius secundus ani pastice serratus. Pinna cauda bifida.

Description: Body stout, rather high, compressed, preventral portion of abdomen rounded, postventral portion compressed to a keel, being crossed by scales. Head somewhat depressed, interorbital space broad. Depth $2\,^{1}/_{4}$ to $3\,^{1}/_{4}$; head 3 to $3\,^{1}/_{3}$, width $1\,^{2}/_{5}$ to $1\,^{3}/_{5}$. Snout longer than eye-diameter, $3\,^{1}/_{4}$ to 4 in head; eye $3\,^{4}/_{5}$ to $5\,^{3}/_{4}$, subequal with snout, 2 to $2\,^{1}/_{4}$ in orbital; maxillary reaches to hind nostril or not quite to eye, length $3\,^{1}/_{8}$ to 4 in head; mouth anterior, broad, jaws about even; interorbital $2\,^{1}/_{5}$ to 3 in head, broadly convex. Gill-openings extending beyond the center of opercle. Gill-rakers rather long, setiform, 3–12, short points. Pharyngeal teeth one-rowed, compressed, flat and grinding surface long, 4–4. Nostrils close together, large, in front of eyes. No barbels present. Preopercle with fine radiating striae.

Scales large, semi-cycloid, basal radiating striae scattered from center, circuli fine; 6 above, vary 5,5 or 6 below to anal origin, 11 to 13 predorsal.

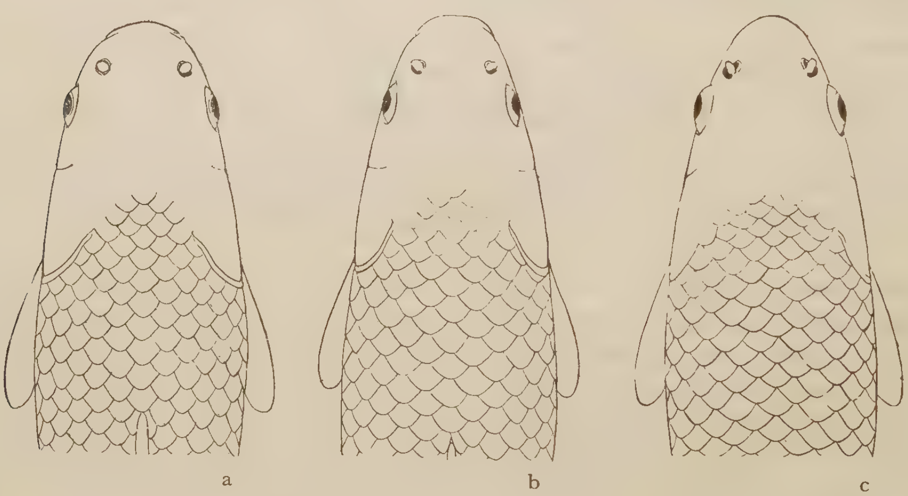
Dorsal fin with IV, 16,1 to 19,1 fourth spine osseous, enlarged, hind edge serrated, originating nearer the tip of snout than to caudal base, or slightly in advance of origin of ventral; length $1\,^{1}/_{2}$ to 2 in head; anal with III, 5, 1, third spine enlarged, osseous, hind edge serrated, length $1\,^{3}/_{4}$ to 2; least depth of caudal peduncle $1\,^{4}/_{5}$ to 2; pectoral fin rounded, reaching to origin of ventral, $1\,^{3}/_{5}$ to $1\,^{3}/_{4}$, rays 15 or 16; ventrals longer

*LINNAEUS, C., Systema Naturae 1758, Tomus I, pp. 321-322.

than pectorals, 1, 8, fin $1\,^1/_2$ to $1\,^2/_3$ in head; caudal forked, tips rounded, $2\,^3/_4$ to $2\,^4/_5$ in rest of fish, lobes equal to the length of head. Air-bladder bipartite, the posterior part larger and longer than the anterior. Peritoneum dark brown. Intestine long, coiled many times; when uncoiled more than 3 times the length of body.

In Japan, the crucian carp was first mentioned in "Hitachi Fûdoki" in 1373 (Wadô 6th) and in Europe scientifically described in 1832 by SUEN NILSON who has separated this form the common carp and established a new genus *Carassius*. This species propagates prolifically, in nature but rather difficult for artificial culture. For this reason, the crucian carp has not been reared in Japan as much as the common carp.

This has a much wider distribution than the common carp, inhabiting temperate regions. This is found throughout Europe, in Turkestan, Siberia and Mongolia. In our country, it is rather more plentiful than the common carp. In habits, the crucian carp is closely allied to the carp. On hot summer days, the schools may bask or swim about near the water surface, but usually lie quietly on the mud bottom or among the weeds.



Text-fig. 88. Three races of Japanese ***Crucian Carp.***
a. "Gengorobuna" b. "Hirabuna" (Ginbuna") c. "Marubuna" ("Kinbuna")

This has also stronger endurance for lower water temperatures than the carp. The rate of growth is somewhat less no, attaining as large size as the common carp. Its nature is feroceous, not tamed by people only in groups, not individually. It is omnivorous, taking small crustaceans, worms, small insects and larva as well as the plants and plants seeds. As mentioned by SASAKI[1)], the female has wider body breadth and longer caudal fins than the male. The appearance of the pearl organ is well-known in the male but sometimes it may exist in the full-grown female as reported by BOKU[2)]. The breeding

1). SASAKI, K., 1934, Botany & Zoology vol. 2, no. 3, pp. 551–552.
2). BOKU, 1937, ditto, vol. 5, no. 6, pp. 1134–1142.

season is in April, May and June, when the eggs are deposited among the weeds. It starts earlier than carp and continues longer than carp. The eggs are adhesive, smaller than the carp eggs, with a diameter of 1–1.5 mm. (1.5–1.7 mm. measured by UCHIDA 1939). We have distinguished three races in Japan; "Hirabuna," "Gengorôbuna" and "Marubuna." "Hirabuna" is also called "Ginbuna". The body is strongly latero-flattened and rather whitish in color. "Gengorobuna" is the most distinct form, one of the races of "Hirabuna." The body is well-flattened bilaterally and the height well marked just at the posterior part of head, the head is broadest at the opercular region and the caudal peduncle is remarkably narrower, the ends of caudal fin rather pointed. This race is peculiar in that it has a light greyish white gloss on the body. Gill-rakers usually numerous, more than 90, and the alimentary canal rather long. These characters are rather distinguished from the typical common carp. This is rather limited in distribution to the Yodo river system connected with lake Biwa. This is more phytophagus than typical race, living in the middle layer of lakes, swamps and rivers with muddy bottoms. The spawning period is from April to July, the eggs are deposited on the weeds in the shallow water.

"Marubuna," the third classification, is also called "Kinbuna." The body generally rounded, with brown and golden color. These three races are distinguished by the outer features, internal characters and also by the ecological characteristics. "Hirabuna" has looser scales than "Marubuna." The rate of growth is the greatest in "Gengorobuna" and least in "Marubuna". "Gengorobuna" is the largest, attaining 20 cm. in body length. There are found many "Gengorobuna" measuring 50 cm. in body length while "Marubuna" scarsely attains 20 cm. in the largest.

For the resistance to oxygen difficiency, "Marubuna" can endure more than the other races, while "Gengorobuna" is extremely weak.

The males of "Hirabuna" and "Marubuna" are very few, the ratio being 100 females to 3–17 males. In "Gengorobuna" the ratios are nearly the equal.

The number of deposited eggs varies with the size of the female. UCHIDA * reported the egg laying capacity of Korean crucian carp as follows. (Table 82)

Table 82. Number of eggs deposited (observed May, 20, 1936).

Body length of female	Number of eggs deposited.	Body length of female	Number of eggs deposited
200 mm.	42,350	234 mm.	45,200
242	68,000	235	52,360
245	68,885	235	47,415
250	91,847	235	68,150
263	102,000	245	46,575
275	177,995	255	44,590
280	147,000	255	88,800
285	192,500	260	76,500
300	172,500	260	52,800
300	199,875	275	73,800

* UCHIDA, 1939, Bull. Fish. Exp. Station, Chôsen, pp. 65–68, pl. 5, figs. 1–6.

From YAMAMOTO's experiments in determing the correlation between the water temperatures and incubation period, the optimum temperatures for hatching out are between 15°–25°C.; 8–10 days in 15°C.; 3 days in 25°C.; and 5 days in optimum temperature around 20°C. UCHIDA [1] has described the development of the present species in 18–23°C. of water temperature.

Development: Two hours after fertilization, the eggs divide into four cells; $2^1/_2$ hours eight cells; 4 hrs. morular stage; 10–12 hrs. blastula stage, 26 hrs. the blastore already closed and eyes and KUFPER's vesicle appear, 6 myotomes on the median part of the body; 72 hrs. hatche sout, larva light green with black chromatophoreson the back, the eye-cup with black pigments intermingled with yellow guanin chromatophores showing greenish yellow.

The larva, just after hatching out, with 4.5–5 mm. body length; the head rather projected from the yolk sac with the mouth opened below; the upper and lower jaws are not well-developed. Myotomes 21 + 11 in number. Eyes on the sides of head, the dorsal membranous fin on the ventral side. The ventral membranous fin is rather narrow, reaching to the middle 66 yolk sac. Yolk sac elongate, the anterior half hemispherical while the posterior half somewhat narrowly elongate reaching to the end of alimentary canal. Black chromatophores appear on the back of head and on the snout as well as on the back of the body. The back chromatophores also arranged in a line along the dorsal ragion of the abdominal cavity and on the vent of the caudal fin.

Larva, 4 days after hatching out measures 6.0–6.2 mm. in body length, has airbladder and well developed jaws. Pectoral fin rather large, fan-shaped. The black chromatophores numerous on the body, distributed irregularly along both sides of the dorsolateral lines.

Larva, 5–6 days after hatching out measures 6.5–7.0 mm. in body length, yolk sac completely absorbed. The black pigments scattered on the lateral sides of the body. Embryo with 14.0 mm. body length exhibits nearly the same outher features as the adult, bearing black chromatophores on the entire body.

Larva, (15.0 mm.) 20–25 days after hatching out, the rays of each fin appear and the preliminary scales are formed. The nostril opens as one pore in this stage and as two pores in the embryo of 30 mm. body length.

The hybrids between the carp and crucian carp has been described from ancient time in Japan. They are called "Koibuna"* in Japanese.

They are easily produced artificially and may be found in nature in Japan as the breeding seasons occur at the same time. The hybrid shows an intermediate from between the two species. It has commonly 33 scales on the lateral line, Varying from 31–36 in number. One pair of short barbels is existed. Pharyngeal teeth are arranged in two lines, each of which have seven in number.

The rate of growth of the hybrid is rather more rapid than crucian carp and somewhat slower than in the carp. The hepatopancreas which is characteristic of the internal

* MATSUI, Y., 1948, Suiden Yogyo (in Japanese), pp. 30-31.

viscera of the carp exists in this hybrid.

TANAKA[1] also reported that hybrids between the two species were recorded in Europe by GUNTHER[2] in 1868 and in the United States of America by GOODE[3] in 1884.

They have four small barbels and pharyngeal teeth arranged one, two, or even three in a row. TANAKA[1] remarked that hybrids have never been found in Japan and that nobody has tried to produce hybrids.

KIMURA, SH.[4] mentioned the intermediate form of crucian carp and goldfish. It is distributed widely in lakes and rivulets near Shanghai in China. It shows red-golden or wholly black color on the body with elongated fins.

CHEVY and LEMASSON[5] reported the hybrid between *Cyprinus carpio* and *Carassius auratus*. KANSANSKY[6] produced hybrids among the species belonging to this genus. The hybrid between *Tinca tinca* ♀ and *Carassius auratus* ♂, usually produced a monster that died ten days after hatching.

In domestication, the crucian carp has run into many variaties, distinguished by differences in form, squamation, and development of fins.

The goldfish was derived originally from the crucian carp and has 20 or more races produced artificially by Japanese and Chinese domesticators. The goldfish is a common Chinese fish introduced in domesticated form into Europe and America. The native goldfish is olivaceous in color and reverts to its natural greenish hue, while the golden yellow color is found only in domesticated specimens and is retained by artificial selection. The goldfish is valued solely for its bright color as an ornamental fish. The forms and colors, as well as patterns, have been produced by selection. They are rather attractive as aquarium fish.

It is now questionable when the goldfish was introduced from China.

One opinion considers the time to be in the middle of *Genwa* (ca. 1617) from the fact that KAIBARA ATSUNOBU (other name, KAIBARA EKKEN) mentioned it in "*Yamato Honzo*" (published in 1629, consisting of 13 volumes). In his sentence, the goldfish has not occurred in Japan in olden times and was introduced from an other country. They are reared by many domesticators. The second opinion considers to have occurred in the beginning of *Tenwa* (ca. 1683), which fact was mentioned in "*Wazi Hajime*," published by KAIBARA KÔKO in 1688 (*Tenwa* 3).

Third opinion suggests the date *Bunki* 2, January 20, which was introduced in "Kingyo Yoganso" published by ADACHI YOSHIYUKI in *Kanen* 1 (1748).

In his description, the goldfish was said to have been introduced from China on January 20th of *Bunki* (1502) into Sakai, Sensyû (Sakai, Ôsaka Fu). At any rate, the goldfish is not indigenous to Japan, surely has been introduced from China in olden times.

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1). TANAKA, SH., 1927, Figur. and Descrip. Fish. Japan, pp. 883–884.
2). GÜNTHER, 1868, Cat. Fish. Brit. Mus., vol. VII, p. 31.
3). GOODE, 1884, Natural History of useful aquatic Animals.
4). KIMURA, SH. 1834, Journ. Shanghai, Sc. Inst, sec. III, vol. 1, p. 147.
5). CHEVY and LEMASSON, 1937, Cont. l'etude Poissons eaux douces Tonkinoises, p. 25.
6). KANSANSKY, 1930, Zool. Anz., 90, p. 167.

These facts are considered by Matsui[1].

The "Wakin" in one of the commonest races of goldfish. The body slender, elongate, with short fin. Caudal fin biforked, homocercal, or triforked and fourforked. Anal fin sometimes two pairs. Body red, white or white and red spotted, but young nearly same hue as the crucian carp. This is the very primitive form and appeared in China about one thousand years ago. In *Bunki* 2 (1502), it was introduced from China and spread widely in Japan from the middle of *Edo* Period.

The "Shubunkin" was produced by the selection as a hybrid between crucian carp and "Sanshiki-demekin". In 1900 (M. 33), this race was produced by the domesticater and is now fixed as a race.

The body dotted with red, white, blue, purple and black spots. The fins are usually longer, the caudal is forked in form as usual. This race is rather strong and one that is suited for rice field culturing. One of the other varieties of the crucian carp, called "Iron-fish 2, "Tetsugyo" in Japanese, is known from some locality is in the Tóhóku and other Districts.

This has a very slender body and longer fins than the typical one, provided with blackish grey in color. This is preserved as a natural monument in some prefectures in Japan. The iron-fish has been reported from several localities of Tôhôku districts of Japan and figured as a varied form in our report[2]. Localities are reported by the author as follows: Higashitazawa, Naka-Hirauchi-Mura, Higashi-Tsugaru-Gun, Aomori Prefecture; Nakano, Nishi-Hirauchi-Mura, Higashi-Tsuruga-Gun, Aomori Prefecture; Shiga-Ura, Asamushi, Higashi-Tsuruga-Gun, Aomori Prefecture; Shimotsuta, Hakkoda, Aomori Prefecture; River Kotomo, Tono-Machi, Iwate Prefecture; Zyohozi-Mura, Ninoe-Gun, Iwate Prefecture; Aramaki-Baba, Nana-Kitada-Mura, Miyagi Prefecture.

Remarks: Gunther[3] observed several specimens from Japan and included them into the present species. *Carassius langsdorfii* from the Lyden Museum (adult specimen from Japan), *C. cuvieri* from the same museum (Half-grown specimen), *C. burgeri* (preserved in Lyden Museum) and Dr. Bleeker's collection (both young specimens) are all included under the present species by him.

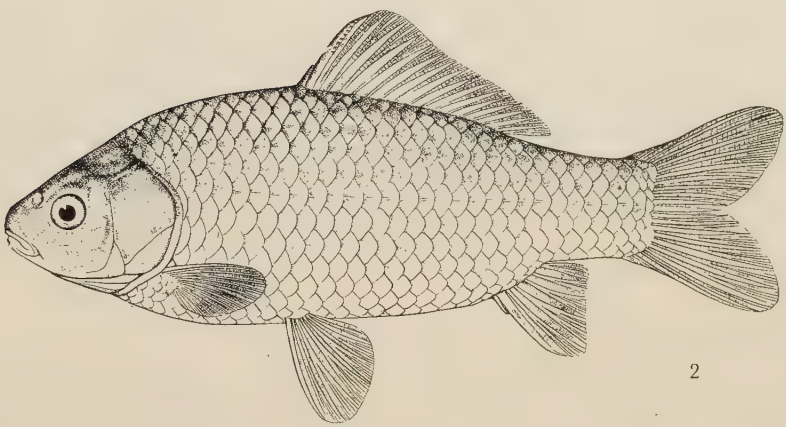
Temminck & Schlegel[4] distinguished the Japanese crucian carp into four species which are rather allied to each other. The first one *Carassius langsdorfii* (PL. xcviii, fig. 1) has been described as a common species found in Japan. The second species *C. burgeri* (PL. xcviii, fig. 2) and the third species *C. cuvieri* (PL. xcviii, fig. 3), which has some what larger head and nasal pores than the second one. The fourth species, *C. grandoculis* (PL. xcvii, fig. 4), is provided with larger eyes than the others, characteristic to the specific name.

1). Matsui, Y. 1935, Kagaku to Shumi kara mita Kingyo no Kenkyû, (in Japanese), pp. 1–421, pls. 1-96, Kôdô-Kaku, Tôkyô.
2). Okada et Ikeda, 1938, Saito Ho-on Kai Museum, Research, Bulletin no. 15, pp. 90–91, text-fig. 2,
4). Gunther, 1868, Cat. Fish. Brit. Mus., p. 33.
3). Temminck & Schlegel, 1842, Fauna Japonica Poissons, pp. 192–195.

PLATE XL



1



2



3

Three races of ***Carassius auratus*** Linn.

1. ***Carassius*** sp. "Kinbuna"
2. ***Carassius langsdorfii***. "Ginbuna"
3. ***Carassius cuvieri***, "Gengorobuna"

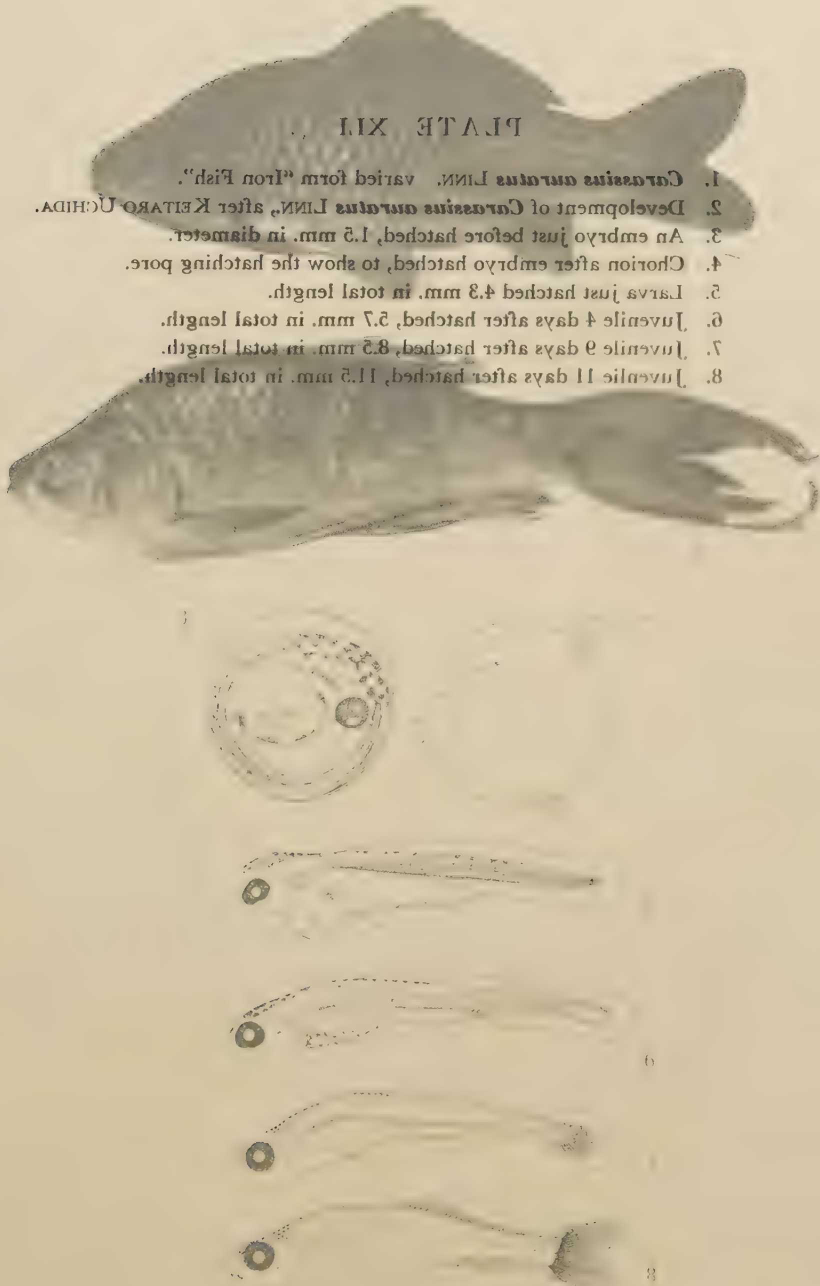
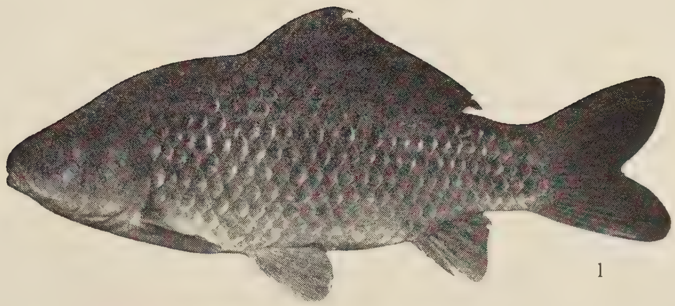


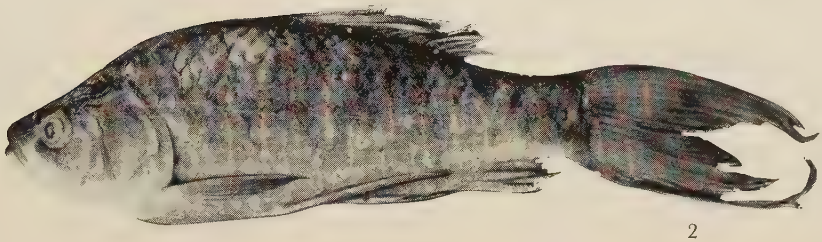
PLATE XLI

1. ***Carassius auratus*** LINN. varied form "Iron Fish".
2. Development of ***Carassius auratus*** LINN., after KEITARO UCHIDA.
3. An embryo just before hatched, 1.5 mm. in diameter.
4. Chorion after embryo hatched, to show the hatching pore.
5. Larva just hatched 4.3 mm. in total length.
6. Juvenile 4 days after hatched, 5.7 mm. in total length.
7. Juvenile 9 days after hatched, 8.5 mm. in total length.
8. Juvenlie 11 days after hatched, 11.5 mm. in total length.

PLATE XLI

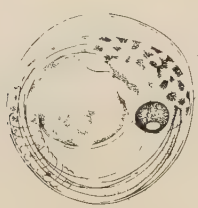


1

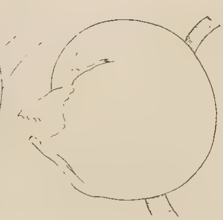


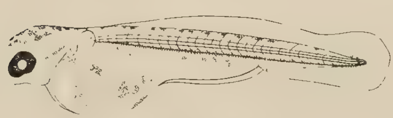
2

3



4





5



6



7



8

Distribution; Japan; Ryû-kyû; Formosa; Korea; Maritime; Amur; Jehol; North China; Yangtse-Kiang; South China; Hainan; Tôkyô (OTAKI); Streams of Japan (JORDAN, TANAKA & SNYDER); Hokkaidô, Honshû, Shikokû, Kyushû (OKADA); River, Senju Tôkyô (TANAKA); Tosa, Sikoku, Kishû (KAMOHARA); Aomori Prefecture; Akita Prefecture; Yamagata Prefecture; Miyagi Prefecture; Fukushima Prefecture (OKADA & IKEDA); Yokohama; Ôtsu; Nagasaki; Matsubara (JORDAN & SNYDFR); Lake Kawaguchi; Lake Yamanaka; Mikawa Bay; Sakura; Yamaguchi; Toyama; Lake Hakone; Lake Kozan; Lake Tôgô (INOMATA); Lake Kasumigaura (HATTORI).

Sub familly Cobitinae

Characters: Body more or less elongate, oblong, compressed, or cylindrical, but never depressed. Head depressed or compressed; snout more or less fleshy, blunt, inferior; the lips fleshy and furnished with from 6 to 12 barbels. Pharyngeal teeth few, in one row and in moderate number; no pseudobranchiae. Scales small, rudimentary, or entirely absent; cycloid, when present, usually immersed in mucous skin and rarely present on the head. Lateral line single; air vessel entirely or partially inclosed in bone. Vertical fins spineless, the dorsal rays varying from 8 to 30, the anal with about 7 or 8, and the ventrls sometimes absent.

Key to the Japanese genera of Cobitinae

a¹. Erectile spine below the eye
  b¹. Barbels 6 or 8; caudal truncate or rounded; air bladder without a free portion in the ventral cavity. .... **Cobitis**
  b². Barbels 6; caudal deeply forked; air bladder with a free portion in the ventral cavity .... **Hymenophysa**
a². No prectile spine below the eye
  c¹. Barbels 10 in number; 4 about the mandible .... **Misgurnus**
  c². Barbels less than 10 in number
    d¹. Barbels 8 in number; a pair of small, slender well-defined barbels near the anterior nostrils; caudal rounded .... **Lefua**
    d². Barbels 6 in number, none at nostrils; caudal rounded, truncate or slightly indentate .... **Barbatula**

Genus Misgurnus LACÈPÉDE, 1803.

Misgurnus LACÉPÉDE, 1803, Hist. Nat. Poiss., v, p. 16.

Characters: Body elongate, compressed. Head triangular, elongate, compressed; snout projecting; mouth inferior, with fleshy lips; barbels 10 or 12, of which 4 are mandibular; eye small. Gill-openings lateral; lateral line complete. No spine below the eye. Body with small scales, except on the head, which is naked. Origin of the dorsal about in the middle of the length of the body, over the ventrals; anal entirely behind

dorsal; pectorals more or less equal to the head; caudal nearly equal to head, and rounded. Air-bladder in a bony capsule.

78. Misgurnus fossilis anguillicaudatus (CANTOR).
Japanese Loach, "Dozyô"
(PL. XLII, figs. 1–11; Text-figs. 89, a-g)

Cobitis anguillicaudata CANTOR, 1842, Ann. Mag. Nat. Hist., IX, p. 485. RICHARDSON, 1846, Ichth. China, p. 300.
Misgurnus anguillicaudatus GÜNTHER, 1868, Cat. Fish, VII, p. 345. - JORDAN et SNYDER, 1901, Check List, p. 45 – JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., vol. XXVI, no. 1332, pp. 766-767. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. X, no. 2, p. 160. – GÜNTHER, 1879, Chall. Rep., p. 72. – SENÔ, KANEGAE, et HIGASHI, 1908, Nihon gyokai Zusetsu, pp. 76–77. – OKADA et IKEDA, 1938, Saitô Hô-on kai Mus., Research Bull., no. 15, pp. 103–105, text-figs. 7, 8. – OKADA et IKEDA, 1938, Sc. Rep. Tôkyô Bunrika Daigaku, Sect. B, no. 55, p. 146. – UCHIDA, 1939, Bull. Fish. Exp. St. Tyôsen, no. 6, pp. 429-439, pl. 45, figs. 1-7, textfigs. 45, tab. 103. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Gap. Arch., pp. 150–155, figs. 123–127.
Cobitis bifurcata McCLELLAND, 1844, Calcutta Journ. Nat. Hist., IV, p. 400, pl. XXIII, Fig. 1.
Misgurnus fossilis anguillicaudatus BERG, 1907, Proc. U. S. Nat. Mus., vol. XXXII, no. 1533, pp. 435–437.
Cobitis pectoralis McCLELLAND, 1844, Caliutta Journ. Nat. Hist., IV, p. 400, pl. XXIII, fig. 3.
Cobitis maculata TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poiss., p. 221, pl. CIII, fig. 2.
Cobitis rubripinnis TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poiss., p. 220, pl. CIII, fig. 2.
Cobitis micropus CUVIER et VALENCIENNES, 1846, Hist. Nat. Poiss., p. 29.
Cobitis psammisums RICHARDSON, 1846, Ichthy., China, p. 300.
Cobitichthys enalios BLEEKER, 1960, Act. Soc. Sci. Indo-Neerl., VIII, Japan; VI, p. 88, pl. II, fig. 4.
Cobitichthys dichachrous BLEEKER, 1860, Act. Soc. Sci. Indo-Neerl., VIII, Japan; IV, p. 89, pl. II. fig. 2.
Misgurnus polynemus BLEEKER, 1860, Act. Soc. Sci. Indo-Neerl, VIII, p. 90, pl. II, fig. 3.
Misgurnus dichachrous GÜNTHER, 1868, Cat. Fish, VII, p. 346.
Misgurnus fossilis TANAKA, 1931, Jour. Fac. Sci. Imp. Univ. Tôkyô, III, part 1; p. 55.

The original description* is as follows;

Cobitis anguillicaudata CANTOR, 1842, Ann. Mag. Nat. Hist., IX, p. 485.

Cobitis anguillicaudata, C. supralinea lateralem, flava, olivaceomaculata, infra cinerea nigro-maculata; abdomine flavo; pimarum radiis flavis, nigropunctatis. apicibus rubris; pinna caudali longissima, cirrhis decem. D. 9; C. 9; A. 7; V. 6; P. 10; Br. 3. Habitat, Ponds, streamlets, canals. Yellow, with olive-brown clouded spots above the lateral line; below the latter gray, minutely spotted with black, and with red extremities. The caudal fin much elongated. Cirrhi 10.

Description: Head 6 in length; depth $6^3/_5$; D. 9; A. 8; P. I. 9; V. 6; width of head 2 in its length; eye 3 in snout, $1^2/_3$ in interorbital space; snout $2^1/_2$ in head; pectoral $1^3/_5$; ventrals $2^1/_2$; scales about 150.

Body elongate, compressed. Head small, triangular, and compressed; snout long, obtuse, rounded and produced; eyes small, anterior and superior; mouth inferior, with

* CANTOR, 1842, Ann. Mag. Nat. Hist., IX, p. 485.

thick fleshy lips; barbels 10, of which 4 are on the lower jaw; nostrils cross together and in front of the eye, the first pair in a short tube; interorbital space slightly convex, much less than length of snout; cheeks not swollen. Gill-openings lateral, joined below in front of base of pectoral. Head naked, trunk covered with small cycloid scales. Origin of dorsal about midway in length of body, including caudal, and directly over ventrals, fin short; anal entirely behind dorsal, and nearer origin of ventrals than base of caudal; caudal oblong, broad, rounded, and about equal to the head; pectorals short and low; ventrals short. Caudal peduncle long and deep, its depth about three fourths the head. Lateral line medium along sides to base of caudal. Color in alcohol dark gray-brown, above spotted and marbled with darker spots smaller on tail, and those on caudal and dorsal fins very small; sides of body with many narrow more or less even longitudinal blackish stripes; lower parts of body together with ventrals and anal, pale; except some dusky on upper part of longer rays. Length $7\,^3/_8$ inches.

Total length 222.5 mm. to 148 mm.; length exclusive of caudal fin 192.5 mm. to 131 mm.. Depth 7.1 to 9.9 in length, at the origin of dorsal fin; head 5.8 to 5.5. Eye 9.5 to 7 in head; snout 2.4 to 2.3; intorobital space 5.5 to 4.9; depth of caudal peduncle 1.7. Length of caudal peduncle 5.6 in length. D. 9 to 8; A. 7–1 to 7. Scales in longitudinal series 169 to 155.

Color and pattern in formalin generally grayish, belly paller; irregular blackish spots are scattered all over body, most of these spots larger than eye; vertical fins finely pitted, paired ones plain. Color in fresh, dark olive on back, light yellowish on belly; small dark spots densely distributed on head and body from lateral to dorsal sides; several dark longitudinal lines on mido-lateral line and on mido-dorsal line; dark minute spots densely distributed on dorsal and caudal fins; a black eye-sized spot on above of caudal fin base; several minute dark spots on the outer side of pectoral fins and anal fin; ventral fin light, rarely has few dark spots, color and patterns are variable on account of the individuals and environments; in the breeding season they are brighter than usual.

Secondary sexual characters: Many reports on the secondary sexual characters of the present species has been published by several authors. I. Matsui (1934) and H. Ikeda (1936). Generally the male smaller than female, very rare in case beyond 120 mm. total body length; rather fewer in number occupying 36% of the female. All the fins of male larger than those of the female, the pectoral and ventral fins dominantly larger. The features and constitutions of the pectoral fin are characteristic; the first branched ray of the male pectoral fin longer, bigger, and broader provided with a narrow necked circular lamina circularis projected posteriorly, extending over the dorsal sides of the 4–5 fin rays. A pair of mounted ridge extending on the latero-dorsal parts of body to the posterior caudal peduncle from the posterior base of the dorsal fin, occupying about $^1/_2$–$^2/_3$ of the head length. According to K. Okamoto, (1921) the skin of the ridge is rather thick, provided with many convoluted cells and flatened ellipsoid adipose tissues occupying between the skin and muscular layers. In the male, pearl organs appear on the rays of pectoral fins, but very minute. The colors are different in

both sexs. Generally the male is reddish orange, rather bright on the body and deep reddish orange on the pectoral, ventral, anal and caudal fins which the female is light dark green on the body and light reddish. These color differences are more distinct in the breeding season.

Table 83. Measurements of *Misgurnus fossilis anguillicaudatus* (CANTOR).

Collection	Fish. Mie Univ.*				
Total length	133. 0mm.	126. 0mm.	130. 0mm.	133. 0mm.	127. 0mm.
Body length	115. 7	109. 2	116. 2	114. 6	113. 0
Body length/Head	5. 65	5. 75	5. 58	5. 73	5. 90
Body length/Depth	7. 10	7. 30	6. 53	7. 15	7. 40
Body length/Predorsal length	1. 77	1. 76	1. 57	1. 70	1. 75
Body length/Prepectoral length	5. 45	6. 02	5. 37	5. 38	5. 95
Body length/Preventral length	1. 66	1. 67	1. 48	1. 63	1. 67
Body length/Preanal length	1. 37	1. 35	1. 21	1. 30	1. 34
Head/Snout	2. 36	2. 72	2. 28	2. 50	2. 74
Head/Interorbital width	4. 65	4. 75	4. 75	4. 45	4. 45
Head/Diameter of Eye	2. 80	12. 60	10. 55	11. 12	11. 60
Head/Length of Caudal peduncle	10. 93	0. 95	0. 91	0. 98	1. 02
Head/Depth of Caudal peduncle	1. 94	1. 61	1. 54	1. 51	1. 74
Head/Length of Dorsal fin	2. 41	2. 32	2. 26	2. 28	2. 34
Head/Length of Anal fin	2. 77	2. 44	2. 47	2. 67	2. 40
Head/Height of Dorsal fin	1. 37	1. 51	1. 61	1. 63	1. 63
Head/Height of Anal fin	1. 62	1. 70	1. 73	1. 91	1. 77
Head/Pectoral length	1. 63	1. 66	1. 56	1. 67	1. 63
Head/Ventral length	2. 28	2. 38	2. 38	2. 11	2. 21
Date	11, VIII, 1954				
Locality	River Machiya, Mie Prefecture				

* Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

Habits: The present species is mostly found in still water of ponds, swamps, canals and rice-fields with soft muddy bottoms and rare in current water. Generally the loaches live in the mud bottom and when they are irritated, soon burry their bodies into the mud.

The elongated body as anguiliform, with mucous skin is adaptive for burrying into the muddy bottom. The eye is situated on the middle of dorsal side of head directing obliquely upward. The general habits of the Japanese loaches has been observed and described by K. ABE[1)] in his book titled on "Culture of loaches" in 1935. The intestine respiration of the loaches has been discussed by A. MINOBE[2)] (1924) and K. SUEHIRO[3)] (1933). K. UCHIDA (1939) also mentioned on the intestinal respiration that the loaches take air from the mouth by floating to the water surface and discharge from the end of cloaca as air bubles into water. The respiration may be carried out in the posterior part of the alimentary canal. The walls of the anterior half of the alimentary canal muscular and thick provided with well-developed mucous membrane inside while the posterior

1). ABE, K. 1935, Dozyô no Yôshoku-hô, Dainihon Suisankai.
2). MINOBE, A, 1924, Zool. Mag., vol. 36, no. 430, pp. 328-330.
3). SUEHIRO, K. 1933, Zool. Mag., vol. 45, no. 542, pp. 494-496.

half is very thin and transparent with developed vessels by which oxygen will be observed. During the winter, the loaches burried under muds for winter sleeping. The food is minute organisms taking together with muds. According to K. Abe, he found small crustaceans, vermes, insect larva and micro-algae in the alimentary canal.

Life history: The breeding season continued from April to June. The loach deposited eggs on weeds of shallow waters and to roots of rice plants of paddy fields. The spawning is carrying out early in the morning. Before the breeding, several males running after one female and are apt to wind their bodies to female.

H. Kobayashi 1) has studied the early development of the present species together with the post-embryonal stages and described in his paper.

Egg: Comparatively small, spherical, measuring 1.27 × 1.41 mm. in diameter, nearly allied to that of *Lefua echigonia*. Size of yellow yolk sac 0.7 × 0.8 mm.. Incubation lasts one or two days at 23–25°C.

Larva: Newly hatched larva, total length, 3.36 mm. (PL. xlii, fig. 4); myomeres 27 to vent plus 17 behind (very incomplete). This is closely allied to that of *C. biwae* in having a large yellow yolk sac, hanging over the snout by the element of barbels. Base of pectorals apparent but not so developed as in *C. biwae*, and as yet has no outer gill.

Pigmentation: Very faint brownish black pigment appears on head, eye and at ventral.

Larva 12–15 hours old (PL.xlii, fig. 5): The larva is very closely allied to the newly hatched larva of *C. biwae*. Two pairs of the outer gill and small pectoral fin fold developed.

Larva 3 days old (PL. xlii, fig. 6): At this stage larva attains about 4.7 mm. in size with four pairs of the outer gill, and a pair of enlarged pectoral as well as two pairs of barbels arising on both jaws. The black pigment prevails on the entire body surface except on yolk sac, and marginal fin fold.

Larva with 5.8 mm. body length (PL. xlii, fig. 7): Total length, 5.84 mm.; body length, 5.05 mm.; head length, 0.95 mm.; diameter of eye, 0.35 mm.; snout length, 0.28 mm.; length of pectoral, 1.13 mm.. Head large and heavy with two pairs of barbels; pectoral very large and funnel shaped. Outer gill nearly covered with opercle. In this stage the larva has completely absorbed the yolk and moves feebly about on the water bottom looking just like a young tadpole.

Pigmentation: Black pigment is densely distributed on the entire body surface.

Juvenile with 11.1 mm. body length (PL.xlii, fig. 8): Total length, 11.15 mm.; body length, 9.68 mm.; body height, 1.75 mm.; head length, 2.50 mm.; diameter of eye, 0.58 mm.; snout length, 0.50 mm.; length of pectoral, 1.62 mm.. Body elongate, slender; all fins rayed eecept ventral, marginal fin fold intact with elevated portion of dorsal. Mouth subinferior with 3 pairs of large barbels.

Pigmentation: Black pigment is distributed densely on the anterior portion of the juvenile, and somewhat faintly on the posterior portion remaining behind the pale color

1). Kobayashi, H. 1922, Suisan Kenkyûshi, vol. 17, no. 6, pp. 129–133.

which is the specific base color of the adult of this common loach.

The juvenile with 18.6 mm. body length (PL. XLII, fig. 9). Total length, 18.60 mm.; body length, 15.70 mm.; body height, 2.00 mm.; head length, 4.05 mm.; diameter of eye, 1.00 mm.; snout length, 1.50 mm.; length of pectoral, 2.72 mm..

Young fish completely formed with five pairs of barbels and marginal fin fold persisting behind dorsal and ventral. About twenty-five or more days after hatching, the young fish reached this stage and are with the adults found abundantly in the ditchs or shallow of the rice field.

Breeding: The embryological studies and the observations of spawning methods of this species were made by H. KOBAYASHI (1922) and by K. ABE (1935). During the spawning season the adult male is provided with small tubercles on the pectoral, and on lamina circularis. On the lateral sides of the dorsal region of the dorsal fin these tubercles appear dilated and taper posteriorly along the body axis.

Feeding habits: The food habits of the adult loach have been investigated but those of the young have not. The early free swimming larva, with a 6–10 mm. body length, feeds largely upon minute aquatic vegetation of the bottom, while the adult, feeds chiefly upon animal matter as *Entomostraca*, *Rotifers* and insect larvae. During the development from the young to the adult, the food consists equally of vegetable and animal matters.

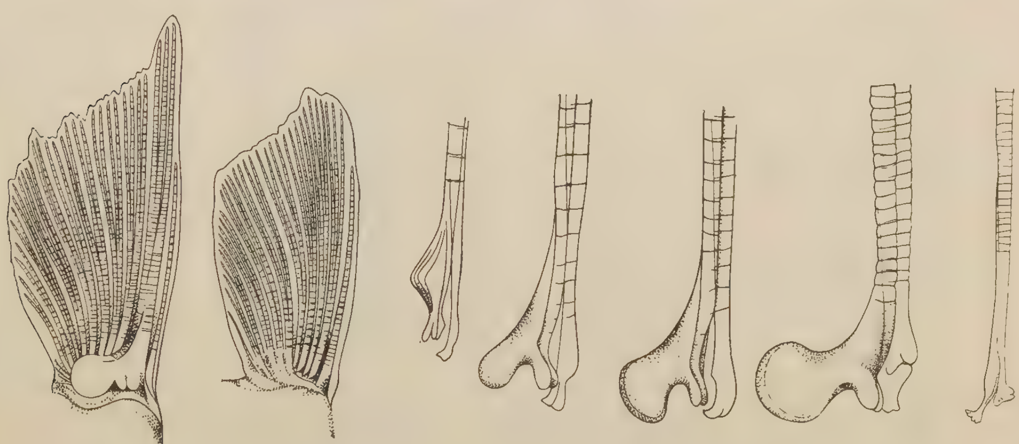
As stated by K. ABE this loach is as omnivorous as the carp, and its food consists of *Entomostracas*, aquatic earth-worms, insect larvae, fragments of land and water plants, seeds of grass and green aquatic algae.

Type locality: Chusan, China.

Distribution: River Yodo, Ôsaka; Lake Junsai, Aomori; Hakodate, Hokkaidô; Tsuchiura; Niigata; Sendai; River Iwai, Ichinoseki; Morioka; Misaki; Tôkyô; Nagasaki; Formosa (JORDAN, FOWLER): Nagano (NAKANO): Kumamoto (WAKIYA); Himezi (ABE): Toyama (S. YOSHIZAWA); Chûsan, China (CANTOR); Kiyoto (GUNTHER); Canton, China (JORDAN & FOWLER); India (MCCLELAND); Nagasaki (SCHLEGEL); China (CUVIER & VALENCIENNES): Canton, China (RICHARDSON) Tôkyô (BLEEKER); Yedo (GUNTHER); River Yodo, Ôsaka; Lake Zyunsai, Aomori; Hakodate; Tsuchiura; Niigata; Sendai; River Iwai, Ichinoseki; Morioka; Misaki; Tôkyô; Nagasaki; Formosa (JORDAN & FOWLER); Lake Abashiri (OKADA); Hirosaki Aomori Prefecture.; Tenno Minami Akita-gun, Akita Prefecture.; River Kitakami, Hareyama Waga-gun, Myozin, Taziro Kadoma Shimohei-gun, Tashiro Kadoma Shimoheigun Shizukuishi, Zyanoshima Morioka Iwate Prefecture; Nobire Wakuya Toda-gun, Okada-bori Shichigo Miyagi-gun Watanoha, Kashimadai Sida-gun, Ozuka-bara Akegami Natori-gun, Nishitaga Sendai, Kawabe Tamatsukuri-gun, Sawanomizo Sunagane Tsurusu Kurokawa-gun Miyagi Prefecture; Tsuruoka Yamagata Prefecture.; River Araumi Minami Aizu-gun Fukushima Prefecture (OKADA & IKEDA); Hakodate, Hokkaidô ISHIKAWA); River Chitose; River Shinoro; River Tobetsu; River Nayoro; River Shôzin Hokkaidô (SOEDA); Ryûku; Formosa (OKADA & KOBA).

Remarks: L. S. BERG (1907) and SH. TANAKA (1936) regarded this Japanese Loach as a subspecies of the European one, calling it *M. fossilis anguillicaudatus* (CANTOR). But, according to V. D. VLADYKOV (1935) and the junior auonthar's observations (1936), it seems justified to distinguish the present species from *M. fossilis* (LINNAEUS) as as separate species. One of the specimens from Ozukabara, Akegami-machi, Natori-gun, Miyagi Prefecture is albescent. In this species, such an albino is occasionally collected, and in life it is wholly cinnabar colored. JORDAN & FOWLER[1] noted *Misgurnus polynemus* (BLEEKER) described by BLEEKER in 1860 for the specimen from Jeddo (Tôkyô). They have not yet seen the specimen up to that time. JORDAN & SNYDER[2] also listed the species from the specimen obtained at Yokohama. Unfortunately the author has not obtained the specimen in Japan.

Sexual dimorphism: IKEDA[3] has remarked the sexual characters of the present species as follows. Male is generally smaller than female. The second ray of the pectoral fin is relatively longer and broader than the others, so that the length of the pectoral fin in in the male is much greater than in the female. The shape of the pectoral fin is somewhat triangular. The width of the ventral part of the second pectoral fin ray is broader than the dorsal part, and is about thrice as broad as the first ray, whereas the dorsal part is only about twice as broad. At the base of this dorsal portion of the second pec-



a b c d e f g

Text-figs. 89. Dorsal view of pectoral fin of ***Misgurnus fossilis anguillicaudatus***, after IKEDA (1936).
a. Large ♂ b. Small ♀ ×3. after IKEDA (1936).
Varied forms of Lamina circularis of ***M. anguillicaudatus***
c. 73.3 mm. body length ×11. d. 77.8 mm. body length. ×12.
e. 86 mm. body length ×7.
Lamina circularis of ***M. fossilis anguillicaudatus*** completely formed. after IKEDA (1936).
f. Left ♂ g. Right ♀×4.

1). JORDAN & FOWLER, 1903, Proc. U. S. Nat. Mus., vol. xxvi, no. 1332, p. 766.
2). JORDAN & SNYDER, 1901, Annot. Zool. Japon., iii, p. 45.
3). IKEDA, 1936, Zool. Mag., 48 (12), pp. 983-994, figs. 1-13.

toral fin ray is located a plate which was termed. "Lamina circularis" by H. RENDAHL (1933). In the Japanese species, the first appearance of this plate is seen when a total body length of about 70 mm. has been reached. The shape of this plate, often it has finished its metamorphosis, is round in outline and the margin slightly denticulate. In the dorsal view of the matured male, the body sides in the region of the dorsal fin appear dilated, tapering posteriorly along the body axis. During the spawning period, the small pearl organs are present on the fin rays of the pectoral fin.

Female has not the above-mentioned sexual characters. The sexual characters of the Japanese species, except for the lamina circularis being marginally denticulate, agree perfectly with the Chinese species, *Misgurnus anguillicaudatus* (CANTOR), described by V. D. VLADYKOV (1935). VLADYKOV stated that the European species, *Misgurnus fossillis* (LINN.), differs from the above-mentioned Chinese one, in having no lamina circularis, the shape of the pectoral fin not triangular, the dorsal part of the second pectoral fin ray broader than the ventral part and the rib-like dilation in the region of the dorsal fin oblique.

D. S. JORDAN and H. W. FOWLER (1903) have distinguished the Japanese species

Table 84. Measurements of *Misgurnus fossilis anguillicaudatus* (CANTOR).

Locality	Date	Sex	Total Length	Body Length	No. Dor.	No. An.	No. Scale	No. Vert.
Zyunyo	V, 30,1935	♀	114.0mm.	96.8mm.	III, 6	III, 5		
—	—	♀	115.9	99.0	III, 6	III, 5	176	46
—	—	♀	115.7	100.3	III, 6	III, 5	156	45
—	—	♀	116.4	99.6	III, 6	III, 5		
—	—	♀	153.8	130.2	III, 6	III, 5	168	49
Mitsuyoko	IX, 22,1934	♀	121.0	103.1	III, 6	III, 5		
—	—	♀	138.7	120.0	III, 6	III, 5	169	45
—	—	♀	149.7	129.5	III, 6	III, 5		
—	—	♀	154.8	133.3	III, 6	III, 5	172	45
—	—	♀	168.1	144.2	III, 6	III, 5	165	45
Fusan Market	X,29,1935	♀	103.9	89.4	III, 6	III, 5		
		♀	105.5	91.0	III, 6	III, 5	157	44
		♀	110.5	95.0	III, 6	III, 5		
		♀	111.0	93.1	III, 6	III, 5	153	42
		♀	117.0	101.1	III, 6	III, 5	162	44

B.L./B.H.	B.L./H.L.	H.L./S.L.	H.L./E.D.	H.L./I.S.	H.L./C.L.	C.L./C.H.	Ph.t.
8.9	5.6	2.6	8.2	5.0	0.9	2.4	
9.0	5.8	2.6	8.1	5.1	0.9	2.1	9–12
7.9	5.6	2.5	8.9	4.8	0.9	2.0	12–?
9.4	5.5	2.5	8.5	5.2	0.9	2.3	
7.8	6.2	2.6	8.6	4.9	0.9	2.1	13–14
7.3	5.4	2.6	8.9	4.7	0.9	1.6	
7.7	6.2	2.7	7.6	4.4	0.9	1.8	13–15
7.8	5.8	2.5	8.4	5.0	0.9	1.8	
7.9	6.2	2.5	8.5	5.3	0.8	1.7	12–12
6.7	6.0	2.5	8.8	5.3	0.8	1.8	11–10
8.3	5.9	2.4	7.5	4.3	0.8	2.0	
7.9	5.8	2.4	8.2	4.4	0.8	1.9	10–10
7.7	5.0	2.7	8.4	5.4	1.0	1.9	
7.7	5.4	2.7	8.9	4.7	1.1	1.5	12–11
7.9	5.8	2.4	9.5	4.6	0.9	1.8	?–11

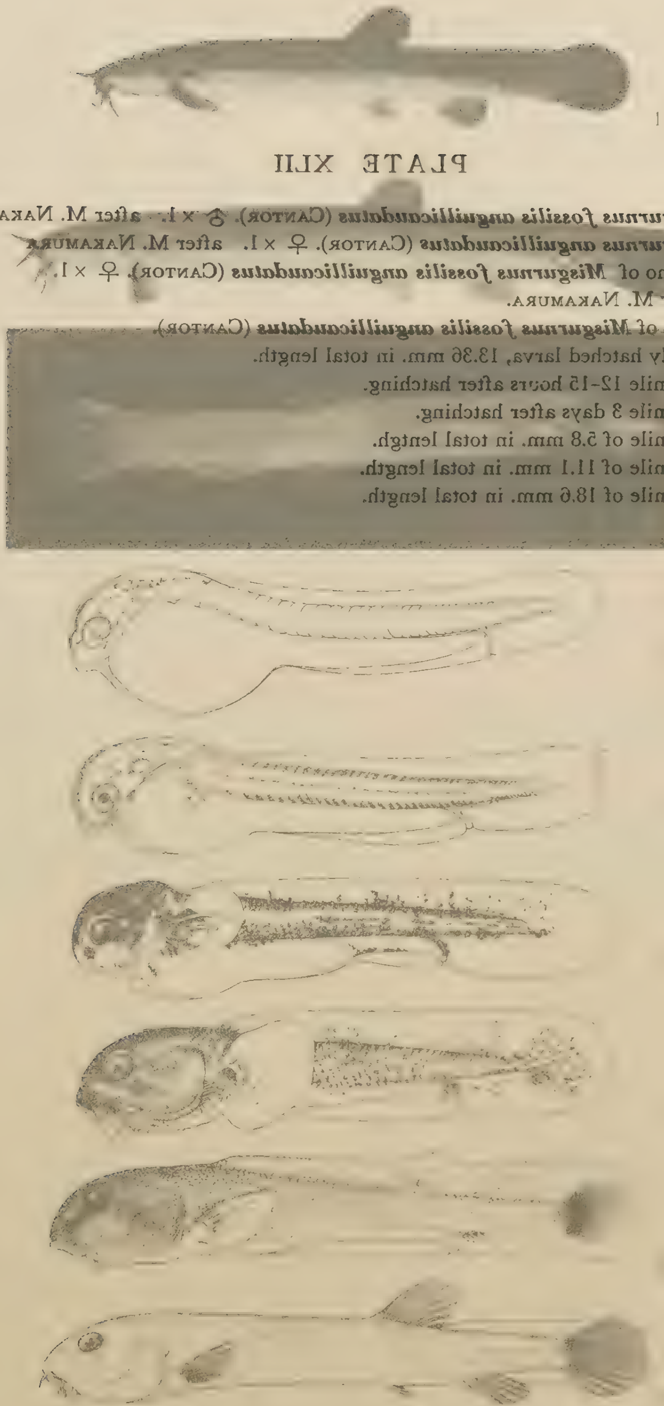


PLATE XLII

1. ***Misgurnus fossilis anguillicaudatus*** (CANTOR). ♂ ×1. after M. NAKAMURA
2. ***Misgurnus anguillicaudatus*** (CANTOR). ♀ ×1. after M. NAKAMURA
3. Albino of ***Misgurnus fossilis anguillicaudatus*** (CANTOR). ♀ ×1. after M. NAKAMURA.

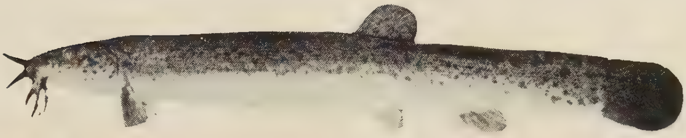
Development of ***Misgurnus fossilis anguillicaudatus*** (CANTOR).

4. Newly hatched larva, 13.36 mm. in total length.
5. Juvenile 12–15 hours after hatching.
6. Juvenile 3 days after hatching.
7. Juvenile of 5.8 mm. in total lentgh.
8. Juvenile of 11.1 mm. in total length.
9. Juvenile of 18.6 mm. in total length.

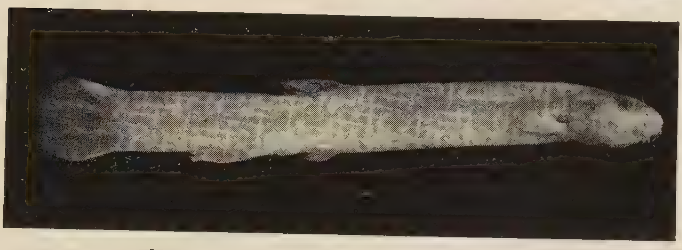
PLATE XLII



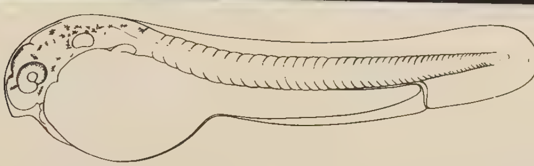
1



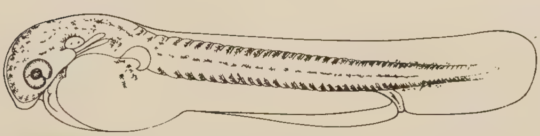
2



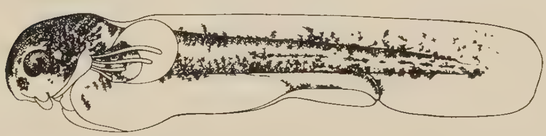
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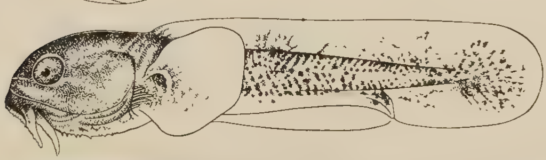
4



5



6



7



8



9

Misgurnus anguillicaudatus (CANTOR) from the European species *Misgurnus fossilis* (LINNANUS). L. BERG (1907)[1] has regarded the Japanese species as a subspecies of the European species, *Misgurnus fossilis anguillicaudatus* (CANTOR) and SH. TANAKA (1931) amalgamated the European species and the Japanese species into one species, *M. fossilis* (LINN).

After comparing the sexual characters of each, he agrees with JORDAN and FOWLER in that the Japanese species and the European species are different and before to sparate species.

H. KOBAYASHI[2] made the description of the scales of the present species. Scale circular, with basal mergin more or less flattened, about 0.38 × 0.4 mm. in young of 4.2 cm. body length and 1.12 × 1.1 mm. adult of 10.7 cm. large. Nuclear area oval, near basal margin, with distinct outline. Apical margin of nuclear area usually nearer to basal margin than to apical. Number of radii increasing with body size, i.e., about 31 in young but in adults. Circuli very fine, all around, more numerous and closer together in adult than in young.

Genus Barbatula LINCK, 1790.

Barbatula LINCK, 1790, Mag. Nuest. Phys. Nat. Gotha, p. 38.
Type = ***Cobitis barbatula*** LINN.

Characters: Body more of less elongate, little compressed, dull-colored, scales very small, imbedded in the skin, not on the head, particularly abundant and varied in high central Asia.

Barbels 6 (3 pairs, none at nostrils). No erectile spine below the eye. Head not laterally compressed, snout pointed. Lateral line distinct, complete or essentially so. Nostrils narrowly separated from eye, close together, the anterior with a flap behind, its ruin little raised in front. Caudal variously rounded, truncate or slightly indentate. Peritoneum black.

79. Barbatula toni toni DYBOWSKI.

Secondary loach, "Fuku-dozyô"
(PL. XLIII, figs. 1–5)

Cobitis toni DYBOWSKI, 1869, Verhandl. Zool.-Bot. Gesellsch. Wien, xxi, p. 597, pl. xviii, fig. 10.
Nemachilus pichiliensis FOWLER, 1899, Proc. Acad. Nat. Sci. Philadelphia, p. 181.
Orthrias oreas JORDAN et FOWLER, 1903, Proc. U. S. N. M., vol. xxvi, no. 1332, pp. 769–770. – TANAKA, 1913, Figur. Descrip. Fishes of Japan, pp. 476–478, pl. cxxxi, fig. 371. – TANAKA, 1913, Cat. Fish. Japan, p. 62. – TANAKA, 1921, Nihongyogaku, p. 198.
Nemacheilus barbatulus toni BERG, 1907, Proc. U. S. N. M., vol. xxxii, no. 1533, p. 438.
Barbatula toni oreas IKEDA, 1937, Zool. Mag., 49 (5), pp. 173–177. – OKADA et IKEDA, 1938, Sci. Rep.

1). BERG, L. S., 1907, Proc. U. S. Nat. Mus., 32 (1533), pp. 435–438.
2). H. KOBAYASHI, 1936, Botany & Zoology, vol. 4, no. 5, p. 854, pp. 861862, fig. 2.

Tôkyô Bun. Daig. Sect. B, no. 55, pp. 146–147, fig. 4. – OKADA et NAKAMURA, 1948, Nihon Tansui-gyorui, pp. 183–184, fig. 110, – MATSUBARA, 1955, Fish Morph. Hierarchy, p. 310.

Barbatula toni UCHIDA, 1939, Tyôsen Gyoruishi, pp. 450–458, pls. 47, figs. 1–7; textfig. 46, 1–4. – AOYAGI, 1957. Gen. Notes Fresh. wat. Fish. Jap. Arch., pp. 155–158, figs. 128–130.

Barbatula toni toni NICHOLS, 1943, Freshwater Fishes China, p. 216.

Oreias toni JORDAN et Metz, 1913, Mem. Carn. Mus., vol. vi, no. 1,pp. 13–14.

Barbatula oreas JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 161.

The original description* is as follows:

xxvi. Art. **Cobitis Toni**. mihi (Fig. 10).

Volksnamen; Burj. Kyptyszyn. sagasu (Liegender Fisch). Russ. Lozen.

Diagn. Kopf lang, deprimirt. Augen hoch gegen die Stirn gerückt, Stirnprofil, flach. Brustflossen bei ♂♂ $^1/_6$ der Totallänge. Alle Flossen abgerundet. Längster einfacher Stützstrahl aller Flossen bedeutend kürzer als der nächstfolgende gespaltene. Totallänge über 200 mm. - Mund von 6 Barteln umgeben. Schlundknochenwinkel einen kurzen spitzen Fortsatz darstellend.

D. $^3/_7$; A. $^3/_5$; V. $^2/_6$; P. $^1/_{10-11}$; C. $^1/_{16}/_1$.

Dentes 10/10.

Häufig in beiden Wassersystemen, doch schwer einzufangen. Laichzeit IV. und V.

Description: Head about 5, depth of body 6 $^1/_3$, that of caudal peduncle 9 $^1/_2$, longest rays of dorsal 6 $^2/_3$, of anal 7 $^3/_5$, of pectoral 6, of ventral 7 $^1/_8$, in total length as measured to base of caudal. Eye 5 $^3/_4$, interocular width 3 $_1/_3$, snout 2 $^1/_3$, in head. D.

Table 85. Measurements of *Barbatula toni toni* (DYBOWSKY).

Collection	O. H. B. S.**		
Total length	112.0mm.	85.0mm.	81.0mm.
Boby length	98.0	75.0	72.0
Body length/Head	4.85	4.85	4.50
Body length/Depth	6.46	5.75	6.55
Body length/Predorsal length	1.98	1.92	2.12
Body length/Prepectoral length	5.10	4.40	4.80
Body length/Preventral length	1.90	1.97	1.90
Body length/Preanal length	1.38	1.41	1.41
Head/Snout	2.22	2.42	2.29
Head/Upper jaw	2.86	3.40	4.00
Head/Interorbital width	3.33	4.25	4.00
Head/Diameter of Eye	5.00	5.67	5.33
Head/Length of Caudal peduncle	1.00	1.13	1.14
Head/Depth of Caudal peduncle	2.00	2.42	2.67
Head/Length of Dorsal fin	2.50	2.42	3.20
Head/Length of Anal fin	2.50	2.42	3.20
Head/Height of Dorsal fin	1.43	1.41	1.46
Head/Height of Anal fin	1.67	1.70	1.78
Head/Pectoral length	1.25	1.31	1.23
Head/Ventral length	1.67	1.41	1.60
Date	IX, 1915		
Locality	Hokkaidô		

** Ôtsu Hydrobiological Station attached to Kyôto University.

* DYBOWSKI, BENEDIKT NALECZ, 1869: Vorläufige Mittheilungen über die Fischfauna des Ononflusses und des Ingoda in Transbaikalien. p. 957.

2, 7; A. 2, 5; P. 1, 1, 11; V. 1, 6; C. X, 1, 16, 1, X; scales in a longitudinal series between origin of dorsal and base of dorsal and lateral line about 20; pores in lateral line about 70; those on either side of back in front of dorsal about 15.

Body slender, elongate, not compressed, uniform in depth from shoulder to vent; caudal peduncle long, much compressed, its width at base 1.66 in its depth dorsal profile nearly horizontal. Head long, dorso-ventrally depressed, conical, tapering to below anterior nostril, not nearly to eye, its width $1\,^1/_2$ in length; eye rather small, directed a little obliquely upward on middle of head, about midway in length of head; interorbital rather broad, convex; snout long, produced, bluntly pointed, with a roundly truncated anterior border overhanging jaws; eye small, elliptical; nostrils two, close together, directly in front of eye, anterior one with a posterior flap, the posterior oblong, with slightly elevated ruin; no spine below eye; lips fleshy. Mouth inferior; barbels 6 in number, of which inner rostral two are the shortest; the rest being subequal in length; none on mandible. Dorsal short, rather high; apex rounded, inserted midway between tip of snout and base of caudal; anal entirely behind dorsal, not reaching to base of

Table 86. Measurements of *Barbatula toni toni* DYBOWSKY*.

No.	Locality	Sex	Total length	Body length	Dorsal fin rays	Anal fin rays	Numb. Verteb.
			mm	mm			
1	Yalu River, Korea	♀	120	100.5	III,8	III,5	—
2	Yalu River	♀	154.7	122.8	III,7	III,5	43
3	Yalu River	♀	188.6	157.8	III,7	III,5	43
4	Siniju, Korea	♂	98.6	81.7	III,7	III,5	40
5	—	♀	101.7	84.8	III,7	III,5	39
6	Tumen River, Korea	?	77.0	63.6	III,7	III,5	40
7	—	♀	96.9	79.5	III,7	III,5	40
8	—	♀	184.2	156.5	III,7	III,5	—
9	—	♂	190.0	157.6	III,7	III,5	44
10	—	♂	190.2	161.0	III,7	III,5	—

B.L./B.H.	B.L./H.L.	H.L./S.L.	H.L./S.I.	H.L./C.L.	C.L./C.H.	Num. Phary. T.	Num. Gill rakers
6.4	4.3	2.2	4.9	1.2	2.1	—	—
6.6	4.6	2.2	4.8	1.3	1.6	8-7	1+10=11
6.5	4.9	1.9	5.2	1.1	1.8	8-8	2+11=13
7.4	4.8	2.2	4.3	1.2	1.8	—	—
6.5	4.7	2.0	3.9	1.2	1.6	7-9	2+10=12
6.3	4.3	2.2	3.9	1.6	1.4	—	—
6.9	4.3	2.2	3.6	1.5	1.4	6-6	2+11=13
6.8	4.5	2.1	5.7	1.2	1.8	—	—
6.0	4.4	2.1	5.0	1.3	1.5	8-9	2+12=14
6.6	4.6	2.1	5.2	1.3	1.6	—	—

*The measurements were made by K. UCHIDA on the specimens collected in Korea, during 1930-1936.

Abbreviations.- B.L.=Body length, B.H.=Body height, H.L.=Head length, S.L.=Snout length, I.S.=Interorbital space, C.L.=Caudal peduncle length, C.H.=Caudal peduncle height, Num. phary. T.=Number of pharyngeal teeth, Num. gill rakers=Number of gill rakers, Num. verteb.=Number of vertebrae.

caudal; pectoral low down, with obliquely truncated posterior margin, extending a little beyond halfway from its origin to that of ventral; ventral inserted vertically below the origin of dorsal, not extending to depressed tip of dorsal, but a little beyond posterior end of base of the latter fin, and also a little beyond halfway between the its origin and that of anal, posterior margin very broadly rounded; caudal well laterally compressed, truncate, with rounded corners. Scales minute, cycloid, but not uniform; imbedded in the skin; head, breast and anterior part of back probably naked; lateral line continuous, slightly decurved anteriorly, running along middle of sides for the rest.

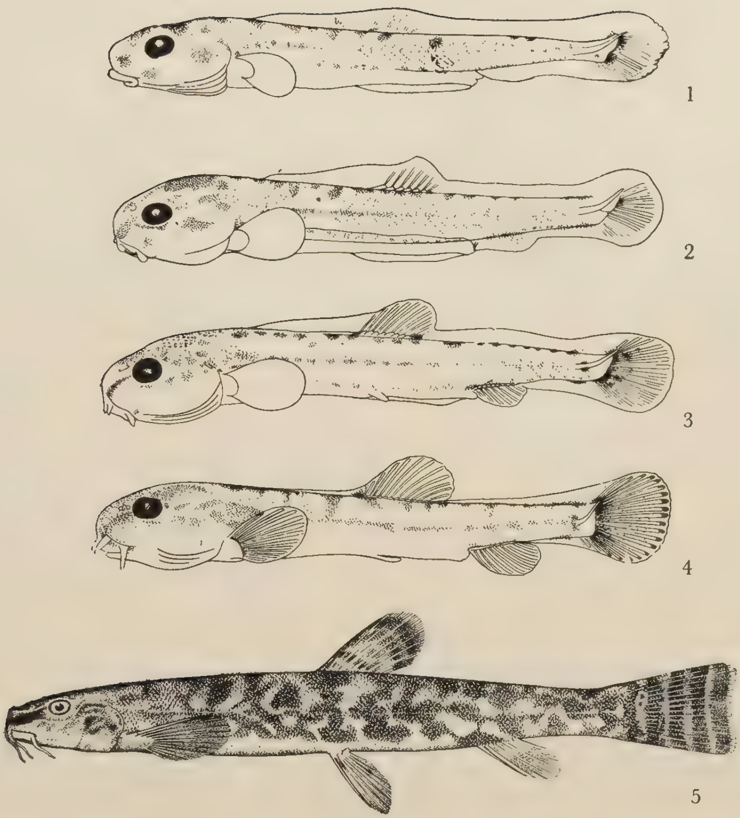
Color in alcohol, dusky above lateral line, irregularly blotched with darker areas, most of which are much larger than eye; sides below lateral line lighter, with indistinct blotches; a broad blackish line on middle of back; another similar one running from anterior margin of eye to tip of snout. Top of head dark, with irregular light specks; sides of head mottled and freokled. Dorsal spotted, the spots forming 4 irregular bars; caudal similar, the spots scarcely arranged in bars; pectoral mottled apically, the spots in 2 irregular bars. Ventral surface white.

Color in fresh, yellowish brown on the back, somewhat lighter on the belly; dark brown irregular patterns on the lateral and back. Small dark brown patterns on the dorsal and caudal fins and light on the ventral fin.

According to K. UCHIDA*, the spawning season may occured during the end of April and the beginning of May in Korea.

Development: Eggs and early larva are not yet reported by previous authors. Post-larva, 8.0 mm. total length without yolk sac. Myomeres about $22+16=38$. Head broad, flattened laterally; snout rounded, mouth half-moon shaped, on the lower side. Upper lip somewhat thicker than the lower lip with numerous minute sen sory papillae. Two pairs of barbel appear anteriorly on upper lip and the third pair on the outer angle of mouth. Five fin rays on the dorsal fin and four on the anal fin. Ventral fin not yet differentiated. Brown pigments chiefly distributed on the dorsal and also located on the head, opercle and snout. Six to seven large black spots on both sides of lateral mid-line of trunk and 3–4 smaller black spots on the dorsal of caudal. These black patterns are irregular in shape and arranged in bilaterally asymmetry. A short lined pattern appears on the mid-line of somewhat posteriorly from the base of anal and the middle of caudal. Few irregular small spots appear on the line of upper and lower muscle layers of both lateral sides. Few small spots appear on the dorsal of the base of caudal peduncle and of the fin rays of caudal fin. Post-larva measured 9.4 mm. in to tal, nearly the same to the former post-larva in outer feature. The outline of dorsal, anal and caudal fins somewhat more differentiated, increasing the number of fin rays. The barbels around mouth are more developed. Post-larva measured 9.4 mm. shows distinct dorsal and anal fins with complete fin rays. Caudal fin rounded and ventral fin small. Patterns are nearly the same to the former larva. Young measured 16 mm. Every fins are completely formed. The black patterns on both lateral sides show

* UCHIDA, K. 1939, p. 454.



Barbatula toni toni Dybowski, after Keitaro Uchida

1. Juvenile 8 mm. in total length.
2. Juvenile, 9.4 mm. in total length.
3. Juvenile, 12.2 mm. in total length.
4. Young, 16 mm. in total length.
5. Adult. × 1

transverse stripes intermingled with irregular ones in shape.

Habits: The present species distributed in Northern China, Manchuria, eastern Siberia, Saghalien and Hôkkaidô, Japan. They are dwelling on sandy and pebble bottom of the rivers and feeding on small aquatic insect larvae, belonging to Ephemenoptera. The breeding season continued from the end of April to the beginning of May or June. The deposited eggs are not yet discovered naturally. UCHIDA collected the young of 8.0 mm body length from Seisen, Korea and mentioned the characters as follows. The head longitudinally depressed and broad and the snout rounded at end. The mouth opened below the snout, forming shallow curve on out line. The upper jaw somewhat thicker than the lower with many minute sence tubercles The anlarge of two pairs of barbels developed at the anterior margin of the upper jaw and the three distinct pairs on the outer margin of mouth angles. Brown pigments distributed mostly on the back and densely on the top of head and interorbital regions. They are also distributed on the middle of opercle, the lateral of posterior head and snout forming one brown pattern on each. Other irregularly formed brown patterns are distributed on both sides of the dorso-median line of the trunk in 6–7 numbers and on the back of caudal 3–4 in numbers. Myomeres about $22+16=38$.

The young of total length measured 16 mm., has distinct dorsal and anal fins and truncated caudal fin. The barbels around the mouth well developed.

Type locality — Transbaikalia.

Distribution: Chitose; Lake Akan; Lake Tôya (OKADA & IKEDA); Hokkaidô; Karafuto (TANAKA); Chitose, Iburi, Hokkaidô (JORDAN & FOWLER); Iburi; Saghalien (JORDAN, TANAKA, SNYDER); River Chitose, Prov. Iburi, Hokkaidô (TANAKA); Utonai Numa; River Shozin, Hokkaidô (SOEDA); Lake Akan, Lake Dôya, Hokkaidô (OKADA & AOYAGI).

Remarks: According to K. UCHIDA's report, secondary sexual characters are somewhat distinct in the present species. In the male, the dorsal, anal and pectoral fins somewhat larger and slightly pointed than the female. Lamina circularis not appears on the base of pectoral fins. Pearl organs very minute, formed densely on the chin, opercles and somewhat sparsely on the back of head and body. No difference of colour distinguished in both sexes.

K. UCHIDA has remarked *Barbatula oreas* found in Hokkaidô is unable to separate from *Barbatula toni* distributed in Asiatic continent as mentioned by T. MORI[1)].

He has also mentioned that H. IKEDA has observed the second sexual characters of *Barbatula oreas* in Hokkaidô and distinguished from the continental species, and not agreed with his opinion.

H. KOBAYASHI[2)] made the observations of the scale of *Barbatula toni toni*. Scales cir-

1) MORI, 1936, Studies on the geographical distribution of freshwater fishes in Eastern Asia.
2) H. KOBAYASHI, 1936, Botany and Zoology, vol. 4, no. 5, pp. 858, 862, fig. 4.

cular, more of less irregular in outline, about 0.67 × 0.79 mm. in an individual 12cm. long. Nuclear area indistinct in outline, with very weak circuli. Nucleus more or less conspicuous, near basal margin. Radii all around, very distinct, about 60 in number in an adult 12 cm. long. Circuli all aroud, very faint in apical area.

Genus **Lefua** HERZENSTEIN, 1888.

Lefua HERZENSTEIN, Wiss. Result. Przewalski nach Central-Asien Reise, Zool., III (2), p. 3.

Type – **Octonema pleskei** HERZENSTEIN

Characters: Small loaches with a round caudal fin; no erctile spine below the eye; eight barbels (four pairs). A pair of small, slender, well-defined barbels near the anterior nostrils. Air bladder with a free portion in the ventral cavity.

Key to the Japanese species of Lefua

a¹ Number of scale 56–73 is longitudinal series; head length about 1⅔ times of that of ventral fin. In male, somewhat distinct dark longitudinal stripe on the lateral side of body and a distinct black spot at the base of caudal fin. Female without stripe and has black spot at the base of caudal fin. .... **L. nikkonis**

a² Number of scale 90–112 in longitudinal series; head length about 2¼ times of that of ventral fin. Without longitudinal stripe and black spot on the caudal fin. .... **L. echigonia**

80. **Lefua echigonia** JORDAN et RICHARDSON.

Buddha-loach

"Hotoke-dozyô, Okamedojô, Yamadojô"

(PL. XLIV, figs. 1–7)

Lefua echigonia JORDAN et RICHARDSON, 1907, U. S. Nat. Mus., xxxiii, p. 264, fig. 1. –. TANAKA, 1909, Ann. Zool. Jap., vol. 7, part ii, p. 129. – TANAKA, 1921, Nihon Gyogaku, p. 197, fig. 67. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, p. 160. – UI, 1932, Kishyû Gyofu, pp. 37–38. – MIYADI, 1935, Kyôto fuka no Tansuigyo, p. 18. – OKADA et IKEDA, 1938, Saitô Hô-on Kai Mus., Res. Bull., 15, p. 105. – NIWA, 1954, Fish Kiso Vall., part 1, p. 288. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 160–162.

The original description* is as follows:

Lefua echigonia JORDAN et RICHARDSON

Head 4⅔ in length, to base of caudal; depth 5¾; D. 7 or 8; A. 1, 7; scales about 90; width of head 1⅖ in its length; snout 3 in head; interorbital space 2½ in head; pectoral 1½; ventral 2¼; eye 2 in interorbital space. Body moderately elongate, compressed behind, caudal peduncle deep, its

* JORDAN et RICHARDSON, 1907, Proc. Unit. Stat. Nat. Mus., vol. 33, p. 264, fig. 1.

depth fully half the length of the head; head depressed, broad and flat above, its width more than two-thirds of its length; eyes anterior, lateral; mouth somewhat inferior, subterminal, with flishy lips, the lower jaw included; barbels 8, one pair nasal, one pair terminal on the maxillary, and two pairs on the muscle anterior to the nasal and superior to the maxillary pair. Scales very small, cycloid, none on the head; lateral line obsolete. Dorsal inserted slightly behind ventrals, the base of its first ray nearer to tip of caudal than to end of snout; anal wholly behind dorsal; caudal rounded, a low adipose membrane procurrent on the caudal peduncle dorsally and ventrally.

Color in spirits olivaceous, densely dusted everywhere except on belly with rather coarse dark specks; a lateral row of obscure, irregularly formed, or more or less broken dusky spots, each nearly as large as eye; a dark humeral spot of rectangular form situated in a pit-like depression; belly pale, whitish; dorsal and caudal finely specked with dusky; other fins plain; no large fin spots or blotches.

This species is related to *Lefua nikkonis* (J. et F.) differing from it, however, in its much smaller scales, shorter ventral fins, and in its coloration, there being no caudal blotch.

Known from three specimens 1 ½ to 1 ¾ inches long from a stream near Nagaoka, in Echigo, Japan, on the northwestern part of the island of Hondô.

The type is Cat. No. 30164 Stanford University. A cotype is in the U. S. National Museum.

Type locality: Stream near Nagaoka, Niigata.

Development: Egg: 1.3 mm. in diameter, with a yellowish yolk, incubation period takes 1 to 2 days ai water temperature 25°C.

Larva: Newly hatched larva, total length about, 3.70 mm. (Pl. 44 fig. 3); myomeres 22 to vent plus 15 behind. Unpigmented body with colourless eyes, characterized by large yellow yolk sac. The bases of the pectorals are slightly developed.

Juvenile 24 hours old: Total length, 4.80 mm.; pectoral large.

Pigmentation: Eye is black. Yellowish brown pigment develops thickly on the top of head, and on the dorsal aspect of the yolk sac. Yellow pigment appears along the margin of the fin fold.

Juvenile 3 days old: Total length, 5.00 mm.. Air-bladder appears, pectorals elongated and mouth and gill opening are beginning to be movable. Outer gills not developed. On the surface of opercular region, many small processes appear. The yolk sac stage lasts about 4–5 days.

Juvenile with 5.1 mm. body length (Pl. xliv, fig. 4): Total length, 5.19 mm.; body length, 4.70 mm.; body height, 1.23 mm.; head length, 1.08 mm.; diameter of eye, 0.36 mm.; snout length, 0.18 mm.. The present larva is characterized by having a blunt, compressed head, and a very large pectoral; one air-bladder and rather large eyes. A particularly interesting characteristic of this larva is, that in the opercular region, there develops minute colourless papillae and which at a later more advanced stage of development arise thickly on the surface of head. Rays begin to develop ventrally in the lophocercal caudal. Pigmentation: The youngs at this stage have many brown pigment spots on the top of head as in many other cyprinids, and also on the dorsal surface extending along the dorsal ridge of intestine from the base of the pectoral to the anal. A few pigmented areas appear on the caudal, and over the air-bladder.

Young with14. 9 mm. body length (Pl. xliv, fig. 5): Total length, 14.90mm.; body

1) Jordan et Fowler, 1903, Proc. Unit Stat. Nat. Mus., vol. 26, pp. 768–769, fig. 1.

length, 11.50 mm.; body height, 2.46 mm.; head length, 3.13 mm.; diameter of eye, 1.01 mm.; snout length, 0.74 mm. Body is short while the head is rather heavy. All of the fins have appeared, and there are 3 pairs of barbels developed, however its surface is ap- parently more smooth than those of other loachs.

Breeding: The spawning season of this loach extends from late spring to late summer. The mating behavior is similar to that of the *Misgurnus anguillicaudatus*. The eggs are separately and very weakly attached to the roots or leaves of water plants in a pond or ditch.

Table 87. Measurements of *Lefua echigonia* JORDAN et RICHARDSON*.

Specimen	A	B	C	D	E	F	G
Length of head	1. 1cm	1. 0cm	1. 05cm	1. 0cm	1. 0cm	1. 0cm	1. 05cm
Diameter of eye	0. 2	0. 2	0. 2	0. 2	0. 2	0. 2	0. 2
Interorbital width	0. 4	0. 4	0. 5	0. 45	0. 45	0. 45	0. 4
Length of snout	0. 4	0. 4	0. 35	0. 3	0. 3	0. 35	0. 4
Length of ventral	0. 6	0. 55	0. 6	0. 5	0. 6	0, 55	0. 5

* These measurements made by TANAKA for the specimens collected Shinano Province.

Food habits: Three distinct periods of growth can be distinguished on the basis of feeding habits, due to the change of living places in succeeding developmental stages.

Plankon-feeding period: When the fishes attain 6–9 mm. in body length they begin to feed, chiefly upon micro-organisms, such as *Tetrophora*, *Zygnema* and *Navicula* which are found near the surface of the water.

Fingerling stage: This is a rather short period, for the fish grows very rapidly, when it is 11 to 13 mm. long. During this stage, the fishes begin to have a bottom life, and feed upon small aquatic animals, (*Cladocera*, *Rotifera*), together with a few water plants.

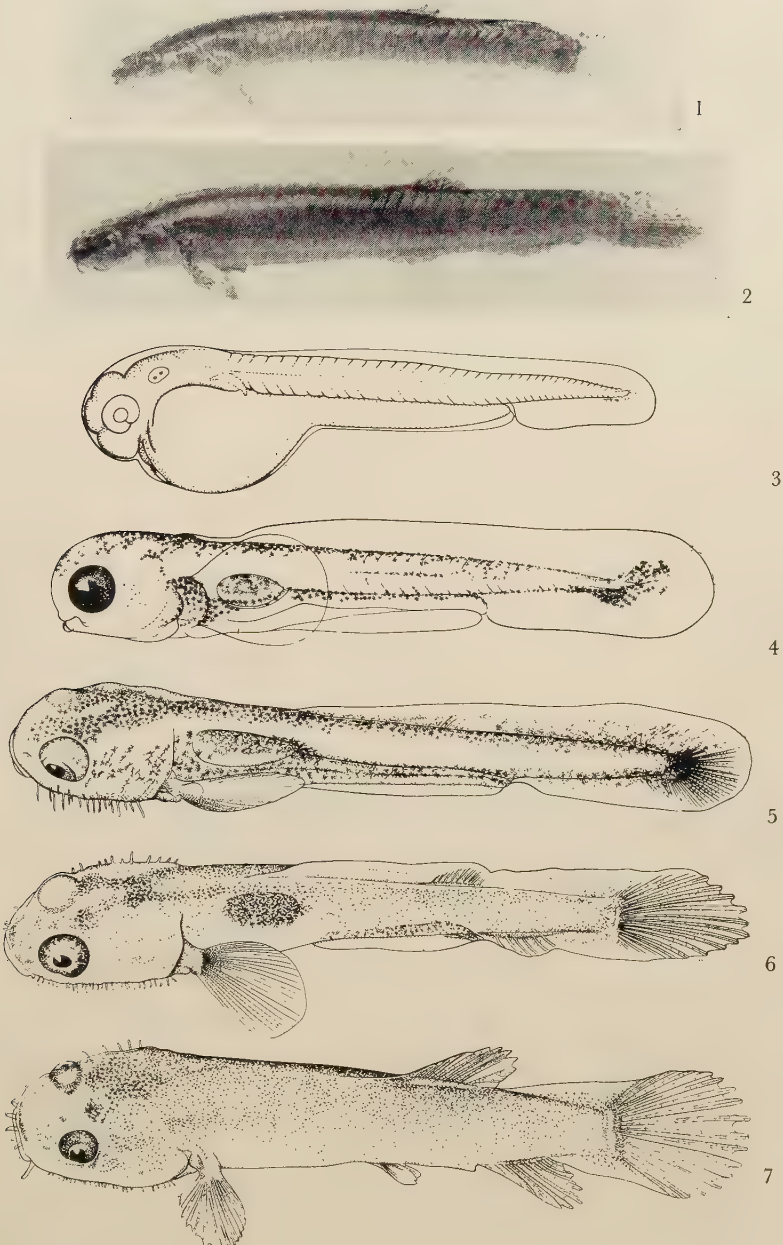
Young period: When the fishes are larger than 20 mm. they have nearly the same diet as that of adult fishes. The fish with developed barbels feed upon different kinds of food composed chiefly of *Crustacea*, *Oligochaeta*, and aquatic insects.

H. KOBAYASHI* has observed the scales of *Lefua echigonia* JORDAN et RICHARDSON and described as follows. Scale oval to somewhat triangular, about 0.4 × 0.24 mm. in the specimen of 4.3 cm. large. Nuclear area large, transparents in center of the scale. Radii all around about 30 in number. Circuli very coarse, widely spaced.

Type locality: Nagaoka.

Distribution: Yamagata Prefecture; Fukushima Prefecture (OKADA & IKEDA); Shinano Province (TANAKA); Shimotsuke, near Nikkô, Tochigi Prefecture (JORDAN & HUBBS); River Hidaka, River Tomita, River Hioki, Wakayama Prefecture (UI); Kyôto fu (MIYADI); River Nakatsu, River Aki, River Fuchi, Kiso Valley (NIWA); River Mogami, Yamagata Prefecture (HASHIMOTO); River Yura, Kyoto (KISHIDA); River Iho, Hyôgo Prefecture (TANAKA); River Kitakami, Iwate Prefecture (TANAKA, KUMAGAYA,

* H. KOBAYASHI, 1936, Botany & Zoology, vol. 4, no. 5, p. 857, p. 862, fig. 3.



1. ***Lefua echigonia*** JORDAN et RICHARDSON. ×1.
2. ***Lefua echigonia*** JORDAN et RICHARDSON. ×1.
3. Newly hatched larva of 3.7 mm. long.
4. Young of 5.19 mm. long.
5. Young of 8.15 mm. long.
6. Young of 10.4 mm. long.
7. Young of 14.9 mm. long.

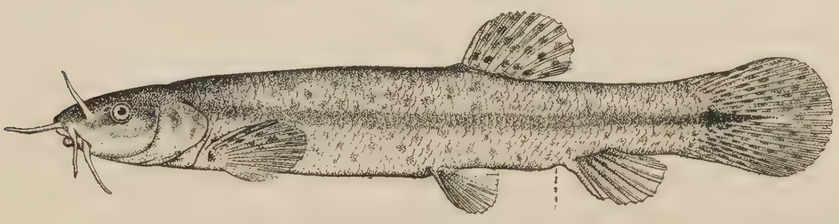
OKADA, AOYAGI).

Remarks: The present species occurs in the middle and northern part of Honshû and not yet known from Shikoku, Kyûshû and Hokkaidô. In these districts, it is commonly found in brooks and lakes. In Aomori Prefecture, it is not yet mentioned.

TANAKA* remarked the color and marking of the present species that they are variable to some extent. Some three longitudinal rows of black spots, each nearly as large as eye, run more or less irregularly. In a specimen 3.2 cm. long as measured in the same way as above, much smaller spots are arranged in somewhat longitudinally running rows; a longitudinal row of large spots which here and there form short lines by confluence, runs along the sides without caudal spot.

81. Lefua nikkonis (JORDAN et FOWLER).
"Ezobotoke"
(Text-fig. 90)

Elxis nikkonis JORDAN et FOWLER, 1903, Proc. Unit. Stat. Nat. Mus., vol. XXVI, pp. 768-769, fig. 1.
Lefua nikkonis OKADA et IKEDA, 1938, Sci. Rep. Tôkyô Bur. Daig. Sect. B, No. 55, pp. 146, figs. 1-3. - OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, p. 182, fig. 108. - AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 158-160, figs. 131-132.



Text-fig. 90. ***Lefua nikkonis*** (JORDAN et FOWLER). ♀ × 1.5

The original description** is as follows:

Elxis nikkonis JORDAN and FOWLER, new species.

Head 4½ in length; depth 6½; D. 8; A. 7; P. 12; V. 6; scales about 56; width of head 1½ in its length; snout 3 in head; interorbital space 2⅟.; pectoral 1½; ventral 1⅔; eye 2 in interorbital space.

Body elongate and rather slender, the tail compressed. Head broad, depressed, and elongate; snout broad, depressed, rounded, and produced; eyes small, anterior, lateral; mouth rather broad, inferior and with fleshy lips; barbels 8, of which there is a nasal pair, and the maxillary pair is the longest, though there are no mandibulars; interorbital space very broad and depressed like the top of the head, flattened; nostrils large, in front of the eyes above. Gill openings rather large, lateral and joined below the base of the pectoral in front.

Scales on the body rather large and cycloid, none on the head.

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* TANAKA, 1909, Ann. Zool. Jap., vol. 7, pt. 11, p. 129.
** JORDAN et FOWLER, 1903, ProcdU. S. Nat. Mus., vol. 26, pp. 768-769, fig. 1.

Origin of the dorsal nearer the tip of the caudal than the tip of the snout, about equal to the height of the body, and its length, when depressed, about three-fourths the length of the head; anal entirely behind dorsal and reaching two-thirds of the space between its origin and the base of the caudal; caudal less than head, and rounded; pectorals small, low, reaching about two-fifths in the space between their origins and those of the ventrals a little before the origin of the dorsal, nearer the gill opening than the base of the caudal, and reaching more than half the distance between their own origins and that of the anal. Caudal peduncle long, equal to head without snout, and its greatest depth 2½ in the length of the head. Lateral line absent.

Color in alcohol brown, dark on the back, and top of the head, with small blotches and mottlings of deeper; along the sides a rather irregularly defined longitudinal dark band, ending in a blackish spot at the base of the middle caudal rays; all the fins more or less spotted with dark brown, deepest, best defined, and largest on the dorsal and caudal; lower surface of the body pale or whitish.

Length 2 13/16 inches.

Type No. 7848, Ichthyological Collections Leland Standford Junior University Museum. Locality, Chitose, in Iburi, Hokkaidô.

Of this species we have a number of examples from the province of Shimotsuke, near Nikkô, and from Chitose, in Iburi, Hokkaidô, the latter received from the Sapporo Museum.

H. KOBAYASHI* described the characters of scales of *Lefua nikkonis* (JORDAN et FOWLER). The scale resembles with that of *Lefua echigonia* and differs by having more numerous radii (about 40 in yearling; about 110 in an adult of six years old in 10 cm. long, with scales measured about 0.92 × 1.59 mm.). Circuli all around, very fine.

Habits: The present species lives in a shallow stream branching from the main river with muddy bottom, as a small channel connected to the paddy field. The breeding season occurs in june around Chitose, Hokkaidô.

Type locality: Chitose, Iburi, Hokkaidô.

Distribution: The present species is distributed only in Hokkaidô. JORDAN and FOWLER (1903) reported of it from Nikkô, Ibaraki Prefecture but none was found out in this district. In Hokkaidô, it is distributed around Chitose and the Shôzin River (SOEDA); Chitose, Komuki-Numa, Hokkaidô (OKADA et IKEDA).

Remarks: According to SH. OKADA, the present species has less number of males than females; the sex ratio is 100:32–66. The color and pattern of both sexes are different. The male is smaller than the female. In the specimens from Chitose, Hokkaidô, the males range from 42mm. to 87 mm. in body length while the females from 38–133 mm. In the male, the end of dorsal fin reaches the anus while in the female, the dorsal fin is shorter and ends somewhat anterior part of the anus. The male pectoral fin is somewhat longer than that of the female and pointed at the end. The minute pearl organs appear densely on the head, the anterior side of abdomen, back, pectoral and dorsal fins.

Genus Hymenophysa McCLLELAND, 1838.

Hymenophysa McCLLELAND, Indian Cyprinidae, 1838, p. 443.
Syncrosous BLTY, Journ. Aisat. Soc. Bengal, 1850, p. 166.

*H. KOBAYASHI; 1936, Botany of Zoology, vol. 4, no, 5, p. 857, p. 862, fig. 3.

Type ············ **Cobitis hymenophysa** BLEEKER

Characters: Body short, deep, and compressed. Head elongate, compressed, and pointed, the snout long, pointed and its tip bluntly rounded; eyes small; mouth inferior and with fleshy lips; barbels 6, the maxillary pair long, and the others close together at the tip of the snout; no mental barbels; a strong bifid spine below the eye in front. Gill-openings lateral. Scales very small. Dorsal inserted in advance of the origin of the ventral; caudal deeply forked. Air-vessel consisting of two divisions, an anterior inclosed in a partly osseous capsule and a posterior which is free in the abdominal cavity.

This genus differs from *Botia* in the presence of but six barbels instead of eight.

82. Hymenophysa curta (TEMMINCK et SCHLEGEL).

Sea loach, "Ayumodoki, Umidojo"
(Text-fig. 91)

Cobitis curta TEMMINCK et SCHLEGEL, 1846, Faun. Jap. Poiss., p. 223, pl. cxii, fig. 4.

Hymenophysa curta JORDAN et FOWLER, 1903, Proc. U. S. N. Mus., vol. xxvi, no. 1332, pp. 773–774. – TANAKA, 1911, Ann. Zool. Jap., vol. vii, pt. 1, p. 2. – JORDAN et THOMPSON, 1913, Mem. Carn. Mus., vol. vi, no. 4, p. 214. – TANAKA, 1913, Cat. Fish. Japan, p. 61. – TANAKA, 1921, Nihon Gyogaku, pp. 198–199. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 160. – MIYADI, 1935, Kyôtofu Tansigyo, p. 19, pl. 2, pl 3, fig. 14. – OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, p. 187. fig. 115. – MATSUBARA, 1955, Fish Morph. Hierar., pt. 1, p. 311. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 171–173, figs. 145–146.

Botia curta JORDAN et SNYDER, 1901, Ann. Zool. Jap., vol. iii, pt. 2, p. 45.



Text-fig. 91. ***Hymenophysa curta*** (TEMMINCK et SCHLEGEL). ca. × 1

The original description is as follows:

Cobitis curta* Pl. cill, fig. 4, 4a et 4b. La quatrième et dernière des Loches du Japon se distingue au premier coup d'aeil des trois précédentes par ses formes raccourcies et sa caudale fourchue. Elle a les joues armées d'un fort aiguillon, et sa bouche est garnie de six barbillons comme celle de la Loche

* TEMMINCK et SCHLEGEL, 1846, Fauna Japon. Poiss., p. 223.

de rivière, mais ces barbillons sont plus longs et les quatre antérieurs sont rapprochés les uns des autres, de sorte qu'ils occupent le devant de la lèvre supérieure. On voit par ces détails que cette espèce s'éloigne non seulement de toutes celles du Japon, mais encore de celles d'Europe pour se rapprocher par ses formes et sous plusieurs autres rapportes de certaines Loches peu connues des Indes, comme par exemple de celles figurées par Hamilton Buchanan, Pl. 11, fig. 96, et Pl. 29, fig. 95, sous les noms de *Cobitis* geta et dario.

Le seul individu de cette espèce que possède le Musée des Pays-Bas est long de deux pouces et un quart. La longueur de la tête entre quatre fois et un quart, la hauteur du tronc cinq fois et demie dans cette léngueur totale. La queue n'est que d'un quart moins élevée que le tronc. La grosseur du tronc fait un peu plus que sa hauteur. La tête offre une forme allongée et conique; la ligne du profil se perd insensiblement dans celle du dos, avec laquelle elle forme une courbure assez douce et régulière. Les yeux, parfaitment latéraux, occupent le milieu de la longueur de la tête; leur bord est libre, et non pas caché sous les téguments de la tête, comme cela a lieu dans les autres Loches du Japon, ainsi que dans celles d'Europe; et ils sont rapprochés du sommet de la tête, qui est arrondie vers le côtés. Les orifices de la narine sont rapprochés du sommet du museau, et s'ouvrent au milieu de l'espace compris entre l'extrémité du museau et le bord antérieur de l'aeil. On voit à l'extrémité du museau deux paires de barbillons naissant d'une base commune; ces barbillons sont assez longspour dépasser la lèvre inférieure lorsqu'ils sont couchés en arrière. Un barbillon, un peu plus long que les quatre antérieurs, pend de chaque côtê de la commissure des lèvres, en sorte qu'il y a en tout six barbillons. La lèvre inférieure, quoique charnue, n'est ni prolongée en un voile ni divisée en deux lobes. La bouche est comme d'ordinaire étroite, et s'ouvrant sous le quart antérieur du museau. Le premier sous-orbitaire forme un aiguillon pourvu à sa base d'une pointe accessoire; mais cet aiguillon, au lieu d'être droit et éloigné de l'aeil comme dans la Loche de rivière, est courbé et forme une partie du bord de l'aeil même, s'étendant en arrière jusque sous l'axe vertical de l'aeil. L'orifice des ouies, étroit comme à l'ordinaire, est recouvert par un opercule un peu anguleux et par conséquent moins arrondi que dans les ausres espèces. La peau dènt la tête se trouve revêtue, est moins épaisse que dans les autres espèces, et les ècailles du corps sont plus petites encore que dans la Loche de rivière, et à peine sensibles à l'aeil nu. Il existe le long du corps une ligne latérale droite et très-apparente. L'anus s'ouvre sur la fin du troisième cinquième de la longueur du corps.

Les nageoires de cette espèce offrent la disposition suivante: La dorsale, aninsi que les ventrales, naissent sur la fin du troisième septeième de la longueur du corps; elle est aussi haute que longue et sa hauteur par devant egale la hauteur de la queue et la longueur des pectorales, qui naissent un peu au dessus de l'angle de l'opercule, et qui sont un peu en forme de faulx. Les ventrales sont peu grandes et peu pointues; elles s'étendent en arrière jusque vers l'orifice de l'anus, qui s'ouvre sur la fin du deuxième tiers de la longueur compris entre l'aiselle des ventrales et la base de l'anale. Cette nageoire est également peu développée et un peu pointue. La caudale, assez large, et considérablement fourchue, se rrolonge en deux lobes pointus. Les bords tranchants de la queue sont formés par de petits rayons avortés et cachés sous la peau. D. 9; A. 6; V. 8; P. 15; C. 20.

La teinte du fond de l'individu qui a servide modéle á norte description est d'un brun rougeâtre pâle. Les nageoires sont jaunâtres, mais la dorsale, l'anale et la caudale sont variées de noirâtre. Cette teinte forme vers le haut de la dorsale une bande assez large; sur le milieu de l'anale, une bande plus étroite et moins foncée; sur la caudale, deux bandes, dont l'une occupe l'extrémité des lobes, l'autre le milieu de cette nageoire, qui offre encore à sa base une tache centrale brunâtre.

Description: Head 4 in length; depth $4\,^3/_4$; D. 12; A. 9; P. 14; V. 8; scales 130; width of head $2\,^1/_2$ in its length, snout $2\,^2/_3$ in the head; pectoral $1\,^2/_3$; ventral $1\,^3/_4$; eyes $2\,^1/_2$ in snout; $1\,^1/_3$ in interorbital space.

Body oblong, rather deep and compressed. Head oblong, compressed and pointed in front; snout long pointed, and compressed, tip bluntly rounded and slightly projecting beyond mouth; eyes moderate, anterior, superior and with eyelid freely circular; mouth

small, inferior, and with fleshy lips; barbels 6, the maxillary pair reaching the eyes, and remaining 4 are close together at tip of snout; nostrils close together; a little nearer eye than tip of snout, and anterior pair in a short tube; interorbital space convex. Gill-openings large, lateral. Body and sides of the head covered with very small cycloid scales. Origin of dorsal about midway between tip of snout and base of caudal, its height about equal to length of pectoral; anal entirely behind dorsal and reaching about two-thirds in space between its own origin and base of the caudal; caudal nearly equal to length of head, deeply forked and lobes pointed; pectorals narrow, lobate, nearly two-thirds length of head, and equal to about half distance between their own origins and those of ventrals; ventrals behind origin of dorsal, and their tips not reaching as far as tip of depressed dorsal, or about two-thirds space between their own origins and that of anal. Caudal peduncle very deep, compressed, its length about equal to ventral and its depth a trifle more but not equal to length of pectoral. Lateral line straight along sides to base of caudal.

Table 88. Measurements of *Hymenophysa curta* (TEMMINCK et SCHLEGEL).

Collection	O. H. B. S.*			
Total length	148.0 mm.	141.0 mm.	139.0 mm.	134.0 mm.
Body length	124.0	116.0	119.0	114.0
Body length/Head	4.07	3.81	4.04	3.86
Body length/Depth	4.28	4.47	4.34	4.45
Body length/Predorsal length	2.03	1.93	1.93	1.96
Body length/Prepectoral length	3.76	3.66	3.97	3.72
Body length/Preventral length	1.77	1.72	1.73	1.64
Body length/Preanal length	1.25	1.25	1.24	1.23
Head/Snout	2.35	2.50	2.56	2.46
Head/Interorbital width	4.35	4.60	4.22	4.30
Head/Diameter of Eye	6.77	7.82	6.55	7.02
Head/Length of Caudal peduncle	1.64	1.90	2.04	2.04
Head/Depth of Caudal peduncle	1.56	1.65	1.78	1.59
Head/Length of Dorsal fin	1.74	1.62	1.78	1.73
Head/Length of Anal fin	3.21	3.30	3.56	3.68
Head/Height of Dorsal fin	1.77	1.71	1.77	1.70
Head/Height of Anal fin	1.99	1.90	2.26	1.90
Head/Pectoral length	1.58	1.56	1.64	1.55
Head/Ventral length	1.88	1.79	2.03	1.88
Date	V, 1932			
Locality	River Yodo, Ôsaka			

*Ôtsu Hydrobiological Station attached to Kyôto University.

Color in alcohol more or less uniform brown, the back slightly darker; body with 8 transverse brownish black bars, the first on the occiput; two others on the caudal; those on the body broadest above and fading out entirely on the ventral region; fifth bar continuous with black base of dorsal; a light bar across dorsal fin, the fin otherwise black with a clear edge, and the anterior edge blackish brown; anal with a black sub-marginal shade and with a brown crossbar. Caudal with two dark crossbars on each caudal lobe, the first across its base, with a central blotch; each lobe tipped with black.

Habits: Breeding season may occur on May in Lake Biwa. They are dwelling on sand-muddy bottom of ponds and lakes.

H. KOBAYASHI described the scale of *Hymenophysa curta* in his paper (1936).[1] Scale elongate oval, with nearly parallel sides and sinuous basal margin, about 1.21×0.66 mm. in an adult 13 cm. long. Nuclear area irregular in outline, near basal margin. Radii conspicuous, all around, about 22 in number in an adult. It is very noticeable that one of the apical radii is always bifurcate. Circuli all around and apical circuli very coarse.

Type locality............Near Nagasaki.

Distribution: River Yodo, Lake Biwa; Okayama Prefecture; Ishidera Naiko, Lake Biwa (OKADA & NAKAMURA); Kihama and Iba, Lake Biwa (TANAKA); Nagasaki; Lake Biwa; River Yodo; River Seta (JORDAN & SNYDER); Otsu, Lake Biwa (JORDAN & KAWAMURA); Matsubara, Lake Biwa (JORDAN & THOMPSON): Lake Biwa; River Yodo; Katsutagun and Eita-gun Okayama Prefecture (MIYADI); Nagasaki (MATSUBARA); River Yodo; Lake Biwa (ISHIKAWA, TANAKA, AOYAGI).

Remarks: NIWA, H.[2] has pointed out that *Hymenophysa curta* is not distributed far east of Lake Biwa, Shiga Prefecture and has proposed the distributional demarcation between River Kiso and River Yodo.

Genus Cobitis ARTEDI, 1738.

Cobitis ARTEDI, Genera, 1738.
Cobitis LINNAEUS, Syst. Nat., 10th ed., 1758, p. 303.
Acanthopsis AGASSIZ, Mém. Soc. Sci. Nat. Neuchâtel, I, p. 36.

Type .... **Cobitis taenia.**

Characters: Body elongate, more or less compressed, and the back not arched. Head elongate, compressed; eyes small, snout produced, blunt and rounded; mouth small, inferior, and with six barbels about the upper jaw; below the eye, an erectile befid spine. Dorsal fin about over the ventrals; anal behind dorsal; caudal rounded or truncate; pectorals less than the head; ventrals below dorsal. Air-bladder inclosed in a bony capsule. Lateral line incomplete. Small fresh water fishes of Europe and Asia. Probably all the species described, will be referred to the widely distributed and variable form described below.

Key to the Japanese species of Cobitis

a^1 Body elongate, somewhat compressed, the dorsal contour not arched; head compressed; interorbital space very narrow; snout produced, blunt. Caudal fin roundish or truncate. Dorsal rays 8 or 8+1, rarely 7+1 or 9; anal rays 6 or 6+1, rarely 7. Gill rakers 15 to 18. Predorsal myotomes 13 to 23. A small erectile befid spine below the eye. Six barbels on the upper jaw.

1) H. KOBAYASHI, 1936, Botany & Zoology, vol. 4, no. 5, pp. 859, 862, fig. 6.
2) NIWA, H. 1954, Fish of Kiso Valley, p. 278.

Air bladder enclosed in bony capsule.

b[1] Lamina circularis present in the male. The pectoral fin long; its length 16.4 to 23.2% in the male, 11.6 to 19.7% in the female; length of head 17.4 to 23.9%; length of snout 7 to 9.7%; diameter of eye 2.7 to 4.5%; length of caudal peduncle 20.2 to 27.5%; distance from the tip of snout to the origin of dorsal fin 47.8 to 59.7%. The orbital streak present.

c[1] Lamina circularis composed of two parts, a beak-shaped apical portion and a round basal portion. Two longitudinal rows of the dark blotches or spots running along the sides of body and these rows being systematically composed of two pigment layers...**C. biwae**

c[2] Lamina circularis composed of simple roundish plate.

d[1] Two longitudinal rows of the dark blotches or spots running along the sides of body and these rows being systematically composed of two pigment layers.
.... **C. taenia matsubarae**

d[2] Two longitudinal black bands running along the sides of body and these bands being systematically composed of single pigment layer............................**C. taenia striata**

b[2] Lamina circularis absent in the male. The pectoral fin short; its length 9.4 to 10.8% in the male, 8 to 10.3% in the female; length of head 14.7 to 17.1%; length of snout 6.2 to 7.7%; diameter of eye 1.9 to 3%; length of caudal peduncle 17. to 21.4%; distance from the tip of snout to the origin of dorsal fin 58.2 to 61.8%. The orbital streak absent.........**C. delicata**

83. **Cobitis biwae** JORDAN et SNYDER.

Striped Loach, Hawk-wing Loach, "Shima dojô, Takanohadojô"
(PL. XLV, figs. 1–6; Text-figs. 92, a–i)

Cobitis biwae JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., 23 (1235), p. 748. – JORDAN, TANAKA et SNYDER, 1913, Catal. Fish. Japan., p. 62. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., 10, (2), pp. 93-346. – MIYADI, 1935, Kyôtô fuka Tansuigyo, pp. 18-19, pl. 3, fig. 13. – KOBAYASHI, 1936, Botany & Zoology, 4 (5), pp. 855-862. – IKEDA, 1936, Zool. Mag. Jap., 48 (12), pp. 983-994, figs. 5-9. -OKADA et IKEDA, 1938, Saitô Hô-on Kai Mus., Res. Bull., 15, pp. 105-107, fig.7. – OKADA et IKEDA, 1939, Sci. Rep. Tôkyô Bunr. Daig., Sect. B, no. 69, p. 101. – OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, p. 184, fig. 111. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 162-166, figs. 134-138.

Cobitis taenia LINNAEUS 1758, Higr. Nat., p. 303. – GÜNTHER, 1868, Cat. Fish Brit. Mus., p. 362. – JORDAN et FOWLER, 1903, Proc. Nat. Mus., vol. 26, no. 1332, pp. 771-773. – BERG, 1907, Proc. U. S. Nat. Mus., 32 (1533), pp. 435-438. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., 6 (4), p. 214. – OSHIMA, 1919, Ann. Carn. Mus., 12 (2-4), pp. – TANAKA, 1913, Journ. Fac. Sci. Imp. Univ. Tôkyô, 3 (1), pp. – KIMURA, 1934, Journ. Shanghai Sci. Inst., 1, – MORI, 1936, Study. Geogr. Dist. Freshwat. Fishes Eastern Asia, p. 18.

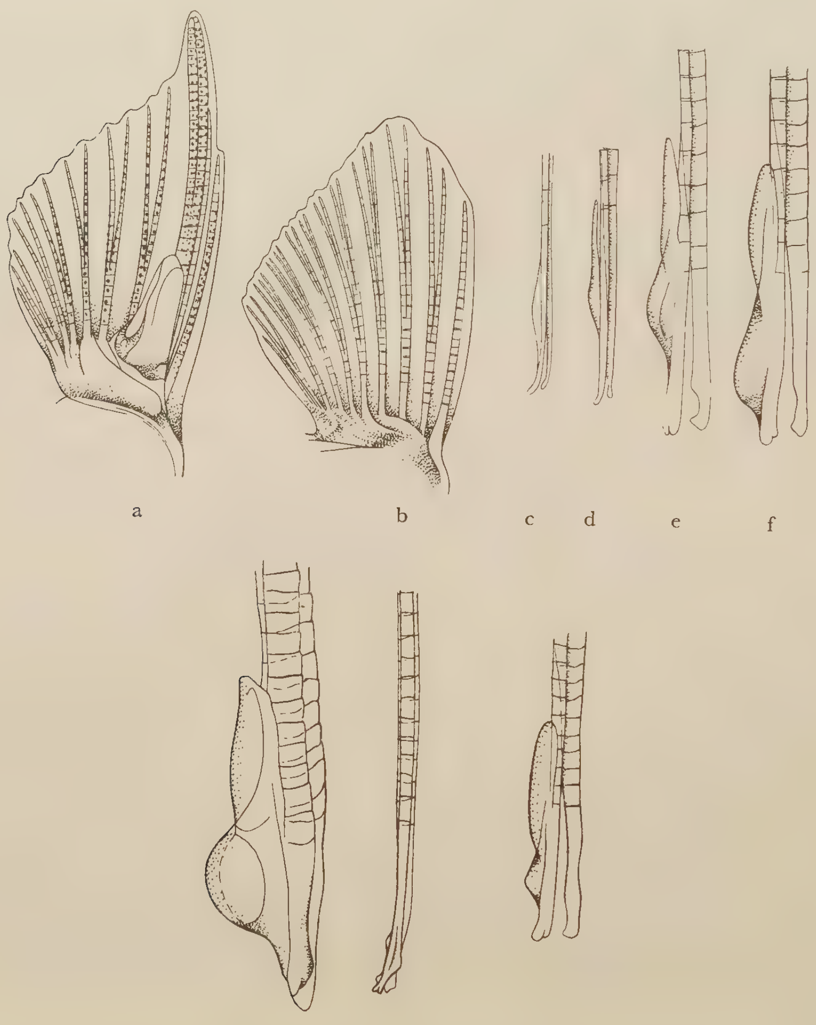
The original description is as follows:

Cobitia taenis

Head 4¾ in length; depth 5⅓; D. 8; A. 7; P. 10; V. 8: width of head, a little over 2 in its length; snout 2¼ in head; pectoral 1½; ventrals 1⅗; eye 5⅔; interorbital space 5⅔.

Body elongate, compressed. Head elongate, much compressed, and with the upper profile convex; snout long, produced, and bluntly rounded; eyes small, superior, lateral, and nearer tip of snout than gill-opening; mouth small, inferior, and with fleshy lips, lower divides and with two lobes; barbels

8, two of which are mandibulars; nostrils nearer the eye than the tip of the snout, close together, and anterior pair in a short tube; interorbital space narrow, about equal to eye and convex. Gill-openings large, lateral, and gill-membrane joined below base of pectoral in front. Scales very small on the trunk, none on the head. Origin of dorsal nearer base of caudal than tip of snout and a little in



a b c d e f g h i

Text-figs. 92. Dorsal view of Pectoral fin of ***Cobitis biwae*** JORDAN et SNYDER, after IKEDA.
a. Larger ♂ ×4 b. Smaller ♀ ×4
black spots indicate pearl organs.
Varied forms of Lamina circularis of ***Cobitis biwae*** JORDAN et SNYDER, after IKEDA.
c. (Left). 38.8 mm. body length ×15 d. 60.4 mm. ×10
e. 79.7 mm, ×9 f. 83.1 mm. ×9
Complete Lamina circularis of ***Cobitis biwae*** JORDAN et SNYDER, after IKEDA.
g. Larger ♂ ×8 h. Small ♀ ×8
i. Varied form of Lamina circularis of ***Cobitis biwae*** JORDAN et SNYDER.

front of ventrals; length of dorsal when depressed a little less than length of head and height of fin much less than greatest depth of body; anal entirely behind dorsal and reaching two-thirds space between its origin and base of caudal; caudal equal to depressed dorsal, and rounded; pectoral 1⅖ in head, and 2⅓ in space between their own origins and that of anal. Caudal peduncle compressed, its length equal to pectoral, and its depth a little less than 2 in the head. Lateral line short, only running a little beyond middle of pectoral.

Color in alcohol pale brownish, dark above, and sides with two rows of dark blotches, those in lower row large, and between two rows a narrow paler marbled brown streak; 6 blotches of dark brown between occiput and origin of dorsal, and 7 more between latter and base of caudal; base of caudal; base of caudal above with a jet-blaxk spot; dorsal and caudal barred broadly with blackish brown; head marbled and spotted with brown above, and a blackish streak from eye to snout; lower surface of the body, pectorals, ventrals, and anal, pale or whitish. Length $3^{13}/_{16}$ inches.

This description from an example from Kawatana, on Ômura Bay. Freshwaters of Japan; our very numerous series from Aomori, Kitakami River, lake near Sendai (collection AWANO), Niigata in Echigo (collection Eitaro IIJIMA), Tamagawa in Tachikawa, Kinu River, in Utsunomiya, Iwai River in Ichinoseki, Tôkyô, Tsuruga, Nagoya in Owari (collection K. OTAKI), River Yodo at Ôsaka, River Chikugo at Kurume, Kawatana, and Lake Biwa.

In this series great variation occurs. The examples from Lake Biwa are very much more elongate and have the brown blotches on the sides merged into a continuous longitudinal band, and the space between it and the superior dorsal row of spots, which is also more or less continuous, light and plain colored, like the lower surface of the body. The colors are alltogether more distinct and sharply defined, and the dorsal and caudal are with only one or two blackish bars. This form has been described from near Nagasaki under the name of "*Cobitis taenia japonica*" by SCHLEGEL, JORDAN & SNYDER mentioned in their paper (1901), that the name *Cobitis japonicus* SCHLEGEL, applied to the common "Shimadojo" or striped loach of Japan, is thus preopccupied, and may give place to the new name *Cobitis biwae* from the largest of the Japanese lakes, where the species abundant. But there seems to be no permanent value in these differences in color and form. Examples from Kawatana and the Chikugo River at Kurume, collected together in both localities, contain both this striped form and those with the lateral bands broken up into spots,

We can not find any difference between the Japanese species and the loach of Europe, and hence retain for it the ancient name of *Cobitis taenia*. Should the Asiatic species prove distinct, the name *Cobitis sinensis* may be retained for it.

Sexual dimorphism: H. IKEDA[1] has noted the sexual difference of the present species in his paper.* Male:– As a rule, the size of the male is smaller than the female. The second ray of the pectoral fin longer and broader than the other species, so that the pectoral fin of the male is relatively longer than that of the female. The shape of the pectoral fin is triangular. The width of the ventral part of the second pectoral fin ray is somewhat broader than the dorsal part, and the dorsal part is about twice as broad as the first ray. At the base of this dorsal part of the second pectoral fin ray is situated the lamina circularis. In the present species, the first appearance of the lamina circularis is

1) IKEDA, H., 1936, Zool. Mag., 48 (12), pp. 984, figs. 5–9.

seen when a total body length of about 35–40 m. has been reached. The plate which has finished its metamorphosis consists of two parts, a beak-shaped apical portion and a round basal one, and is marginally denticulate. During the spawning period, the small pearl organs are present on the fin rays of the paired fins. Female:– In the female, the above-mentioned sexual characters are not present.

Development: Egg: Diameter of egg, 2.11 mm.; diameter of yolk, 1.07 mm.; with 12–13 small oil globules. Egg membrane is very thin, colourless and yolk whitish, almost transparent. Incubation lasts about 2 to 3 days at the water temperature of 23–26°C. Larva of 48 hours after fertilization, extends about two-thirds around the egg; anterior portion of yolk is very large and round, followed by an elongated portion beyond which the tail is free. The larva just before hatching out has coiled more than once around the egg, and tail reaches to back of head; two paris of outer gills are developed; myomeres are well-formed. The faint brownish pigments appear on the top of head and on eyes. Newly hatched larva (PL. XLV, fig. 4): Total length, 4.56 mm.; myomeres 27 to vent plus 13 behind.

Body elongated, with a large yellow yolk; two paris of outer gills and pectoral apparent. The origin of barbels is distinctly observed. Pigmentation: Small brownish pigment develops thickly to eyes, and on the top of head, prevailing on dorsal ridge and dorsal margin of yolk sac from pectoral to ventral fins.

Young, two days after hatching out (PL. XLV, fig. 5): Total length, 5.10 mm; myomeres 25 to vent plus 10 behind. The young of this stage has long outer gills, which easily distinguished it from any other kind of young fish. The present young very closely resembles the larva of *M. anguillicaudatus* in having a large pectoral, well-developed barbels and in the distribution of pigments. Pigmentation: dorsal aspect of head is heavily pigmented with brownish black chromatophores extending to dorsal and ventral aspects, and marking the myomeres. Development of the caudal rays are recognized by concentration ventrally in lophocercal caudal.

Young with 6.0 mm. body length (PL. XLV, fig. 6): Total length 6.04 mm.; body length, 5.26 mm.; head length, 1.36 mm.; diameter of eye, 0.36 mm.; snout length, 0.26 mm.; length of pectoral, 1.31 mm.; length to vent, 4.26 mm.; myomeres 27 to vent plus 11 behind. The young at this stage have a compressed head; yolk almost reduced and enlarged at pectoral aspect nearly covering outer gills. Pectoral very large, occupying a quarter length of the entire body but unrayed. Two pairs of barbels well developed and processes around the lower jaw raised. Pigmentation: the marking of this young is essentially the same as that of previous stage. The snout, inner-orbital region and the top of head are covered with brownish chromatophores. About ten large chromatophores are distributed from the dorsal ridge of the intestine to vent, and many in lophocercal caudal. The orientation of the dorsal is evidently marked with a concentration of the pigment is scattered on the entire body surface but more densely distributed at the marginal fin fold.

Young with 18.4 mm. body length (PL. XLV, fig. 7); total length 18.40 mm.; body

length, 16.00 mm.; body height, 2.22 mm.; head length, 4.10 mm.; eye diameter, 0.80 mm.; snout length, 1.80 mm.; pectoral length, 2.80 mm.

The young fish has almost all the diagnostic characters of the adult. All fins apparent and rayed, the mouth small and horizontal, which adapts it to the habits of feeding on the bottom. The spine underside of eye appear at the 18.5–18.8 mm total length stage. Pigmentation: from the early stage the coloration appears in proper color patterns and its numbers almost cleaned, spotted on lateral side and on dorsal ridge, but the striated one which appeared in the myotomes of the mid line of lateral is still very light.

Breeding: The present species spawns in the late spring to mid summer. The males have a prominent pearl organ with spiny tubercles on the paired fin rays. They have the lamina circularis at the base of the second pectoral fin ray. Before the spawning season, the parents seek the grassy slow streams, and then deposit the egg separately on the roots or leaves of water plants in the early morning.

Food habits: This is also a bottom feeder and like the common loach, has well-developed barbels all of its life from early in its embryonal stage. The food of this fish is essentially the same as that of the common loach, however, in the early stage of the larva of 5 to 16 mm. total length, it is composed entirely of protozoa (*Lacquereusia*, *Arcella*). This fact gives an interesting light on the study of biology on the filter bed of water works. S. SAKAI and his colaborator has reported that presence of this loach in the filter bed is quite harmful for pure filteration.

Habits: The present species dwells mostly on the sandy bottoms of clear lakes and rivers and often buried under the sand. It feeds on small benthic animals. The spawning occurs during May and June, in streams, a branch of rivers. It was exporting to U. S. America for the appreciation.

Type locality: Lake Biwa.

Distribution: The present species seems to be properly distributed in Japan proper excepting the southern and western parts of Kyûshû. Ôhata; Nohezi; Nonai; Jusan-Mura; Hirosaki; Takata-Mura and Katasawa-Mura; Aomori Prefecture; Asamai-Machi; Hanadate-Mati; Niage-Mura; Futatui-Mati and Yazima-Mati; Akita Prefecture; Hatiro-Gata; Hanamaki; Morioka Haruyama; Iwate Prefecture; Wakayanagi-Machi Miyagi Prefecture; Kawatari-Mura; Wakuya-Mati, River Okada, Sendai, Miyagi Prefecture; River Arauni; Fukushima Prefecture; Yusa, Turuoka, Yosshitori-Mura, Yamagata Prefecture; Sawara, Tiba Prefecture; River Furutone, River Katura, Yamagata Prefecture; Numata, Gunma Prefecture; Murakami-Mati Niigata Prefecture; Lake Hamana, River Kiso, Shizuoka Prefecture; Uziyamada, Mie Prefecture; River Katura, Kyoto-Fu; Koyama Ike, Tôttôri-Prefecture; Lake Sinzi, Shimane Prefecture; River Yoshino, Nara Prefecture; River Kururyu, Ôita Prefecture; Yamada-Mura, Kagawa Prefecture; River Ôita, Ôita Prefecture; Lake Biwa, Shiga Prefecture; (OKADA & IKEDA); Okayama; Lake Biwa (JORDAN & THOMPSON); Honshû; Shikoku; Kyûshû, except with the western part (OKADA & NAKAMURA).

Remarks: As to the systematic point of view for Japanes *Cobitis*, D. S. JORDAN and J. O. SNYDER (1901) have distinguished *Cobitis biwae* JORDAN et SNYDER from the European *Cobitis taenia* LINN., while JORDAN and FOWLER (1903) combined the Japanese, European and Chinese species into one species, *Cobitis taenia* LINN. Further more L. BERG (1907) has regarded the Japanese and European species as same calling them *C. taenia* LINN. but distinguished them from the Chinese species, *C. taenia sinensis*. Considering about these opinion, we decided the Japanese peculiar species as *Cobitis biwae* JORDAN et SNYDER, by having the quite different characters of lamina circularis in the male.

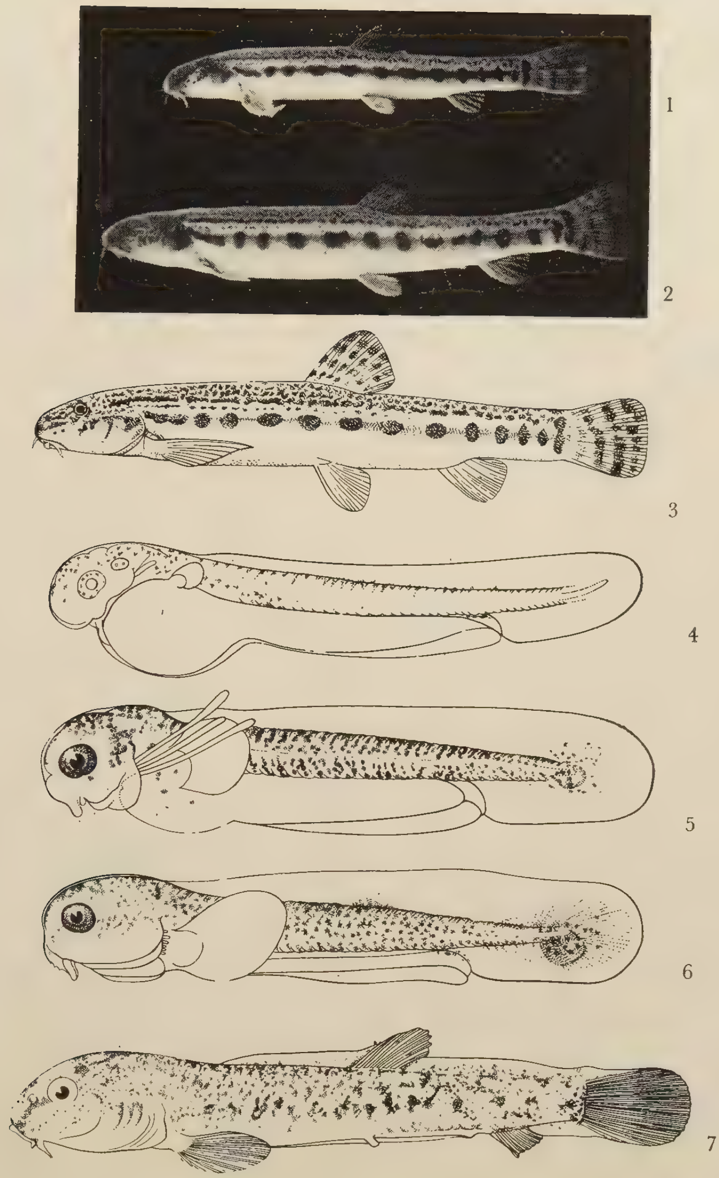
IKEDA and the author remarked the great variations in the coloration and the pattern from the specimens preserved in Saitô Hô-on Kai Museum., Sendai, Japan. The numbers of the spots on the lateral sides of the body and the dorsal axis are greatly varied as shown in the table 80.

Table 89. Number of the spots in the body side and the dorsal axis of *Cobitis biwae* JORDAN et SNYDER.

Reg. No.	Total length	In body side	Dorsal axis In pre-dorsal	In dor-sal fin	In post dorsal	Caudal blotch
1029	42mm.	13	5	2	6	distinct
—	67.5	13	5	2	5	distinct
—	91.2	13	5	2	5	not present
1114	57.3	13	6	2	5	not present
5620	76.0	8	5	2	7	not present
11337	78.1	8	4	2	4	distinct
11735a	77.3	9	5	2	4	not present
11735b	45.5	12	7	2	6	distinct
11735c	48.5	13	6	2	6	distinct
—	51.6	13	6	2	5	not present
11735d	64.6	12	6	2	4	not present
15136	75.9	12	6	2	6	in-distinct
16124	78.0	12	6	2	5	not present
17722	64.0	8	4	2	9	in-distinct
20200	64.3	12	6	2	5	distinct

H. KOBAYASHI has observed the scales of the present species and described them in his report. The scale is nearly circular, measuring 0.2 × 0.26 mm. in youngs and 0.31 × 0.32 mm. in adutls. The margin is somewhat sinuous. The nuclear area large, transparent, without sculpture, with indistinct outline, a little nearer to basal margin than to apical. Radii somewhat broad, about 15 in number in 4 cm. youngs and 25 cm. in 6.5 cm. adults. Circuli rather coarse, all around. Apical circuli a little more widely sepaced than those of basal.

PLATE XLV



1. ***Cobitis biwae*** Jordan et Snyder, after M. Nakamura. × 1 ♂
2. ***Cobitis biwae*** Jordan et Snyder, after M. Nakamura. × 1 ♀
3. ***Cobitis biwae*** Jordan et Snyder. × 4/5 ♀
4. Newly hatched larva, 4.56 mm. long.
5. Juvenile two days after hatching out, 5.1 mm. long.
6. Juvenile of 6.4 mm. long.
7. Juvenile of 18.4 mm. long.

84. **Cobitis taenia striata** IKEDA.

Striped loach, "Suzishima dojô"

(Text-figs. 93, a–f)

Cobitis taenia striata IKEDA, 1936, Zool. Mag., 48 (12), pp. 984-985, figs. 10, 11, 12, 13. – OKADA et NAKAMURA, 1948, Nihon no Tansuigyo, pp. 185–186, fig. 113. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 168–170, figs. 142–143.

Cobitis taenia (pars) JORDAN et FOWLER, 1903, Proc. U. S. N. M., vol. xxvi, no. 1332, pp. 771-772.

The original description is[1] as follows:

D. S. JORDAN and H. W. FOWLER (1903) mentioned that in the Japanese Shimadojō, collected at the Chikugo River, two color patterns, a striped form and a spotted one with the lateral bands broken up into the spots, were seen. Their striped form seems to fit *C. taenia striata*, while the spotted one seems to fit *C. biwae* JORDAN et SAYDER. According to my observations, *C. taenia striata* possesses superficially

Table 90. Measurements of *Cobitis taenia striata* (IKEDA).

Collection	Fish. Mie. Univ.*				
Total length	69. 0mm.	70. 0mm.	83. 0mm.	76. 5mm.	77. 0mm.
Body length	59. 0	60. 0	72. 0	65. 5	66. 0
Body length/Head	4. 92	5. 13	5. 15	5. 05	5. 15
Body length/Depth	6. 56	6. 12	6. 85	6. 35	6. 80
Body length/Predorsal length	2. 02	2. 23	1. 97	1. 98	2. 03
Body length/Prepectoral length	6. 08	5. 00	5. 14	4. 93	5. 27
Body length/Preventral length	1. 99	1. 93	2. 07	1. 98	2. 00
Body length/Preanal length	1. 35	1. 30	1. 32	1. 47	1. 31
Head/Upper jaw	2. 66	2. 67	2. 33	2. 60	2. 56
Head/Interorbital width	7. 92	7. 52	7. 00	7. 65	8. 00
Head/Diameter of Eye	5. 16	5. 45	5. 60	4. 82	5. 34
Head/Length of Caudal peduncle	1. 10	1. 26	1. 17	1. 23	1. 16
Head/Depth of Caudal peduncle	2. 38	2. 18	2. 00	1. 94	2. 00
Head/Length of Dorsal fin	2. 08	2. 00	2. 00	1. 91	2. 04
Head/Length of Anal fin	2. 48	2. 50	2. 42	2. 60	2. 84
Head/Height of Dorsal fin	1. 21	1. 31	1. 27	1. 21	1. 28
Head/Height of Anal fin	1. 52	1. 26	1. 47	1. 57	1. 46
Head/Pectoral length	1. 62	1. 45	1. 69	1. 73	1. 56
Head/Ventral length	1. 74	1. 54	1. 80	1. 78	1. 71
Date	V. 1954				
Locality	Lake Biwa, Shiga Prefecture				

* Faculty of Fisheries, Prefectural University of Mie.

quite similar sexual characters to those pointed out for *C. biwae* JORDAN and SNYDER. However, the more striking differences between them are as follows.

Male: The second pectoral fin ray is broader than the others but the length is not so much greater as in a case of *C. biwae* JORDAN and SNYDER. In *C, taenia striata*, the first appearance of lamina circularis is seen in a total body length of about 40 mm. The lamina circularis which has finished its metamorphosis is a simple round plate. Such a shape of this plate perfectly agrees with that of the European species, *C. taenia* LINN., described by V. D. VLADYKOV (1935).[2] During the spawning period,

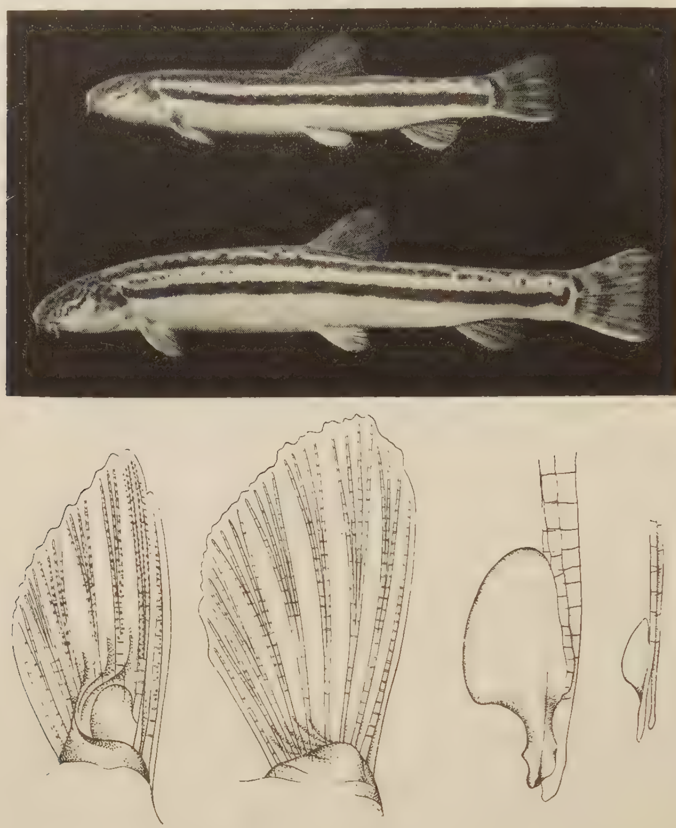
1) IKEDA, H., 1936, Zool. Mag., 48 (12), pp. 984–985; figs. 10–13.

2) VLADYKOV, V. D., 1935, Journ. Morph., 57(1), pp. 275–302.

the small nuptial tubercles are present on the fin rays of the paired fins.

Female: In the female, the above-mentioned sexual characters are not seen.

Type locality: not mentioned.



a

b

c d e f

Text-fig. 93. a. ***Cobitis taenia striata*** IKEDA. ♂ × 1, after M. NAKAMURA
b. ***Cobitis taenia striata*** IKEDA. ♀ × 1, after M. NAKAMURA
Dorsal view of pectoral fin of ***Cobitis taenia striata*** IKEDA, after IKEDA
c. Small ♂ (× 10). d. large ♀ (× 6).
Black spots on the rays of the fin indicate Pearl organ.
e. Complete lamina circularis (71.7 mm. body length × 10).
f. Incomplete lamina circularis (49.6 mm. body length × 12).

Distribution: Ôsaka; Kagawa Prefecture, Shikoku (IKEDA); Shiga Prefecture; Ôsaka; River Takatsu, Shimane Prefecture; Takamatsu, Kagawa Prefecture (OKADA & NAKAMURA); River Kuzuryu, Fukui Prefecture (AOYAGI); Lake Biwa (JORDAN, FOWLER, AOYAGI); Nagasaki (TEMMINCK & SCHLEGEL).

Remarks: IKEDA has noted the sexual difference of the present species as follows. "Male: The second pectoral fin ray is broader than other but the length is not so much greater as in a case of *C. biwae* JORDAN and SNYDER. In *C. taenia striata*, the first appe-

arance of lamina circularis is seen in a total length of about 40 mm. The lamina circularis which has finished its metamorphosis is a simple round plate. During the spawning period, the small nuptial tubercles are present on the fin rays of the paired fins."

81. Cobitis taenia matsubarae OKADA et IKEDA.

"Yamato-Shima-Dozyô"

Cobitis taenia japonica TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poiss., p. 222. - IKEDA, 1937, Scie. Rep. Tôkyô Bunrika Daig., Sect. B. No. 69, pp. 101–102.
Cobitis taenia matsubarae OKADA et IKEDA, 1939, Sci. Rep. Tôkyô Bunrika Daig., sect. B. 4, pp. 78–104.
Cobitis taenia AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 166–168, figs. 139–141 tab. 1.

The origioal description* is as follows:

Cobitis taenia japonica
PL. CIII, fig. 3 et fig. 3a.

Les eaux douces du Japon produisent une Loche tellement semblable a la Loche de rivière d'Europe, qu'il est presqûe impossible de distinguer ces poissons nés dans des régions aussi distantes l'une de l'autre, et qu'il faut comparer entre eux desindividus d'égale grandeur, pour pouvoir saisir les caractères subtils que nous leur assignons. En effect cette Loche de rivière du Japon offre absolument la même organisation, les mêmes formes aninsi que la même taille celle d'Europe. Elle a, comme cette dernière, la bouche garnie de six barbillons disposés autour de la lèvre supérieure; ses joues sont armées de chaque côté d'un aiguillon pourvu à la base d'une petite épine; les nageoires offrent une disposition tout à fait semblable, et leurs nombres sont absolument les mêmes; la distribution des teintes ne diffère le plus souvent en aucune manière; en un mot, ces deux poissons sont absolument semblables et ne paraissent s'éloigner l'un de l'autre que par des différences assez légeres dans l'étendue des nageoires et dans la disposition de la dorsale; cette dernière nageoire étant un peu plus reculee vers le devant, tandis que les nageoires en général, à l'exception de la caudale, paraissent être tant soit peu plus petites dans la Loche de rivière du Japon que dans celle d'Europe.

Quant aux teintes, il existe au Japon des individus, absolument semblables sous ce rapport, à ceux d'Europe; d'autres au contraire forment une jolie variétè, remarquable parce que les deux rangées de taches brunes qui ornent de chaque côté le dos, sont remplacées par deux raies longitudinales. Notre figure 3a, Pl. CIII, représente cette variété, tandis que l'on voit, sous n°. 3, la figure faite sur le vivant d'un individu semblable à ceux des equx douces de l'Europe.

Nous ne possédons qu'une sixaine d'individus japonais de cette Loche; ils sont tous conservés dans la liqueur forte.

Distribution: Hishikari-mura, and River Sendai, Kagoshima Prefecture; River Chikugo, Shiba-mura, River Yana, Iogima, River Naka, Fukuoka, Prefecture; River Chikugo, Hida, Ôita Prefecture; Nagasaki, Nagasaki Prefecture; Western part of Kyûshû, Japan. (AOYAGI & OKADA).

Remarks: D. S. JORDAN and J. O. SNYPER (1901) substituted *C. taenia japonica* TEMMINCK et SCHLEGEL with *C. biwae*, regarding *C. taenia japonica* as the species representing

*TEMMINCK et SCHLEGEL, 1846, Fauna Japonica Poissons, p. 222.

all the Japanese striped loaches. In 1937 the junior author suggested that *C. taenia japonica* Temminck et Schlegel incluces the two species, *C. taenia japonica* proper, the spotted form, and *C. taenia striata* Ikeda, the striped form. According to our observations, the striped loaches from the western part of Kyûshû, from where *C. taenia japonica* Temminck et Schlegel was recorded, are clearly distinguishable from the forms regarded as *C. biwae* Jordan et Snyder and collected in other parts of Japan in having the simple lamina circularis. We would suggest that *C. taenia japonica* Temminck et Schlegel should be substituted with the new name, *C. taenia matsubarae*, and be distinguished from *C. biwae* recorded by D. S. Jordan and J. O. Snyder in 1901.

86. Cobitis delicata Niwa.

"Adime Dozyô"

(PL. XLVI, figs. 1–5; PL. XLVII, figs. 1–13)

Cobitis delicata Niwa, 1937, Zool. Mag. Japan., 49 (2), pp. 72–74, figs. 1–2. – Niwa, 1937, Zool, Mag. Japan., 51, p. 2. – Okada et Matsubara, 1938, Nihonsan Gyorui Kensaku, p. 79. – Okada et Ikeda, 1939, Sci. Rep. Tôkyô Bunrika Daig., sect. B, 4, p. 69. – Okada et Nakamura, 1948, Nihon Tansui gyorui, p. 186, fig. 114. – Matsubara, 1955, Fish Morph. & Hierarchy, pt. 1, p. 311, – Aoyagi, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 170–171, fig. 144.

The orginal description* is as follows:

Cobitis delicata, sp. nov.

Japanese name: Adime-dozyo

D. 8; A. 6; P. 8; V. 7 (without rudimentary rays)

Head 6.7 in body length; depth 7.1; width of head 1.8 in its length; height of head 1.6 eye 6.7; interorbital space 5.0; snout 2.0; height of caudal peduncle 1.8; dorsal (longest soft ray) 1.7; anal 1.8; pectorals 1.5; ventrals 2.2; caudal 1.3; width of body 1.5 in its depth.

Body elongate, slender and compressed. Head very short, much compressed, and with the upper profile convex; snout long, produced, and bluntly rounded; eyes very small, superior, lateral, and a little nearer the tip of the snout than the gill-opening; mouth small, inferior, and with very fleshy lips, the upper arched, the lower almost straight, and not divided so distinctly, thus the shape of the mouth is semicircular; barbels 3 pairs, the 1st and 2nd above snout and the 3rd at both ends of the lower lip, their length about equal with the eye diameter; nostrils nearer the eye than the tip of the snout, close together, and the anterior pair in a short tube; interorbital space narrow, a little broader than the eye, and convex.

Trunk elongate, tail comparatively short, length of tail 3.6 in length of trunk. Dorsal situated far backward; distance from the origin of dorsal to the base of caudal 2.5 in body length; ventrals a little behind dorsal; myomeres 21 between pectorals and ventrals; anal entirely behind dorsal and reaching half the space between its origin and the base of caudal; length of dorsal when depressed much less than head length; pectorals small, their length 4.8 in the space between their own origins and those of the ventrals; ventrals very small, their length 3.2 in the space between their own origins and that of the anal; caudal a little longer than depressed dorsal, its height larger than its length, and

*Niwa, 1937 Zool. Mag., 49 (2), pp. 72–74.

subtruncate. Caudal peduncle much compressed, its length much longer than pectorals, and its depth 1.6 in its length. Lateral line indistinct. Scales very small on the trunk, none on the head.

Colour in formalin pale yellowish, with a marbled drown streak on lateral line, and dorsal surface is dotted with many irregular spots; head with numerous blackish spots; lower surface of the body, pectorals, ventrasl and anal, pale and whitish.

Total length 75.0 mm.

This description is made from a male specimen from the River Agi, branch-stream of the River Kiso. I have many specimens from the above mentioned place and some other river (Kiso, Ôtaki, Tuketi, Nakanoho, Hida, Nagara, Itadori, etc.) in Central Japan.

Sexual differences of this species are not distinct, even in their spawning period.

Habits: The number of eggs in a female is according to sizes. During November 6 and December 6 of 1938, I have got many materials contained nearly ripened eggs, from the upper River Nagara, near Hotojima, Yamagata-gun, Gifu Prefecture.

According to H. Niwa descriptions, the present species is dwelling in the mountain streams and rivers by the cold water stenothermal and polyoxybiotic fish.

Table 91. Number of eggs in a female of *Cobitis delicata* Niwa.

No. sp.	Dates	Number of eggs	Size of specimens	No. sp.	Dates	Number of eggs	Size of specimens
1.	XI, 6, 1938	167	92mm.	15.	—	180	95mm.
2.	—	148	83	16.	—	226	95
3.	—	180	84	17.	—	155	87
4.	—	135	78	18.	—	235	84
5.	—	151	82	19.	XII,6, 1938	106	72
6.	—	126	72	20.	—	94	72
7.	—	177	88	21.	—	37	72
8.	—	139	84	22.	—	91	63
9.	—	136	84	23.	—	85	75
10.	—	133	77	24.	—	66	63
11.	—	129	83	25.	—	117	73
12.	XI, 5, 1938	131	86	26.	—	98	75
13.	—	124	80	27.	XII,6, 1938	112	72
14.	—	179	95	28.	—	49	71
					Average	*131.29*	*79.93*

The food of other loaches is mostly consisting of small *Crustaceans*, worms and aquatic insect larvae while that of the present species is chiefly micro-algae as *Diatomes*, *Desmids*, *Chlorophyceae* and some aquatic insect belonging to *Chironomidae*.

In autum, when the water temperature of rivers is gradually go down, the fish dispursed widely before gathered together and come into a spring chinck to spend over the winter. Although it is quite difficult to observe how *Cobitis delicata* is spending his life in the spring chinck during the winter, he supposed the fish is making a crowd in the chinck at that time.

The breeding season may occur from December to January. It is rather rare case to breed during the winter, as *Lampetra reissneri*, *Salmo gairdneri irideus* and *Hypomesus olidus*. The eggs are rather large, measuring 2.0 mm. in diameter. The number of eggs in a female and their sizes are as follows: (Tables 91–92).

According to the above tables, the minimum number of eggs contained in a female 124 while the maximum number is 235.

The eggs are cubical, measured 2.1mm. in average diameter (the ripened egg is 2.4 mm. in diameter). The yolk of unripened egg is yellow and changes into deep reddish orange when the egg is ripe.

The minimum size of female, measured 66 mm., ripes the ovary and that of male, measured 48 mm. ripes the testis. Such adult may be one year old, growing the young

Table 92. Number of eggs contained in a female and their sizes.*

No. sp.	Body length	Contained eggs number	Diameter of eggs.	Colour of eggs.
1	86mm.	94	2.0mm.	reddish orange
2	91	117	2.0	—
3	89	105	1.9	—
4	91	99	0.1	—
5	83	90	2.1	—
6	81	104	2.0	—
7	83	119	2.1	—
8	84	97	2.0	—
9	85	95	1.7	—
10	83	95	2.0	—
Average	5.6mm.	101.5	2.0mm.	

Table 93. Number of eggs contained in a female and ther sizes.**

No. sp.	Body length	Contained eggs number
1.	86. mm.	131
2.	80	124
3.	95	179
4.	95	180
5.	95	229
6.	87	155
7.	84	235
8.	92	167
9.	83	143
10.	84	180
11.	78	135
12.	82	151
13.	72	126
14.	88	177
15.	84	136
16.	77	133
17.	83	129
18.	84	136
Average	*84.94*	*156.82*

**Observed by the author on the specimens collected at Hotojima, Yamagata-gun, Gifu Prefecture, during 1938.

hatched out in January of the same year. From these facts, the gonad may be ripened in the end of the first year.

Sex ratio and sexual difference: During November and December, we obtained many specimens at Hotojima, Yamagata Gun, Gifu Prefecture and observed the sex ratio of the spawning season. From the data, I could confirm the sex ratio is not constant through the season. During the beginning of November, the male appears in less number than the female and the sex ratio may be 1 : 1.7 while the end of December, the male suddenly increase in number and the sex ratio changes into 2.5 : 1.

The secondary sexual characters exhibited in other species of Cobitidae are not observed in the present species. Pearl organs and lamina circularis are not appeared in the present species but the female somewhat larger than the male, measuring 83.6 mm. (♀) and 63.2 mm. (♂) in average maximum sizes and 6.6 mm. (♀) and 48 mm. (♂) in average minimum sizes.

* This measurement made by H. Niwa in 1954 from the specimens collected at River Fuchi, Gifu Prefecture on September 29, 1951.

Furthermore an indistinct character of the sexual difference shows only in the length and shape of the pectoral fin; in male the pectoral fin is smaller and shorter than in female.

Type locality...............River Agi, branch-stream of the River Kiso.

Distribution: River Shonai, River Takeori, River Kiso (branches, Ena valley River Kawakami, River Fuchi, River Aki, River Nakanokata); River Hida (branches Ma-River Suda, River Umase, River Wara, River Sami, River Shiro, River Kuro, River Aka); River Nagara (branches River Itatori, River Mugi); River Ebi (branches River Hirose , River Neo); River Jinzu (River Miya, branches River Kawakami, River Takahara); River Shonai (River Shira) Gifu Prefecture; River Kiso (branches Kiso Valley, River Tamataki), Nagano Prefecture; River Kumozu, River Miyakawa (branches Kisohara valley); River Isuzu; River Kizu (branches River Hattori), Mie Prefecture; River Kuzuryu (branches River Hino); Fukui Prefecture (Niwa); River Miya, River Kumozu, River Isuzu, River Hattori, Mie Prefecture (Okada & Kubota).

The present species has a particular distribution, limited in the middle Japan including Gifu, Mie, Nagano and Fukui Prefectures.

Remarks: The present species resembles *Cobitis biwae* Jordan et Snyder, but is quite easily distinguished from the latter or its allied species by its larger number of myomeres (21–23, P-V),very fleshy and semicircular mouth, far backward situated dorsal and ventrals, shorter head and barbels, smaller eyes and fins, indistinct sexual dimorphism, etc. This species also resembles *Cobitis multifasciata* Wakiya et Mori, a Korean species, in its shorter head and fins, but differs from it in the following points: body is not so compressed, its depth 7.1 in body length (8.5 in *C. multifasciata*); distance from the origin of dorsal to the base of caudal 2.5 in body length (2.75 in *C. multifasciata* short); anal reaching half distance from its origin to the base of caudal (two-thirds in *C. multifasciata*); dorsal a little in front of ventrals (in *C. multifasciata* ventrals a little in front of dorsal); lower lip not divided so distinctly, and almost straight (in *C. multifasciata* divided distinctly and with two lobes); barbels 3 pairs and short (in *C. multifasciata* 4 pairs and longer); eyes very small, its diameter 6.7 in head length (4.7 in *C. multifasciata*). H. Niwa published a book titled with "Fish of Kiso Valley ecological studies of the river fish fauna. part. 1. Investigation of upper parts of the River Kiso and its Tributaries", and in this book he has treated chiefly on *Cobitis delicata*. He mentioned the taxonomic datas compared with other species of Japanese loaches and the secondary sexual characters and also the geographical distribution and local variations. He added the ecological distribution, food habits hibernation, breeding season and the transplantation. He has remarked the difference of the present species from other allied species. It resembles *Cobitis biwae* Jordan et Snyder, but is quite easily distinguished from the latter or its allied species by its larger number of myomeres (21–23, P-V), very fleshy and semicircular mouth, far backward situated dorsal and ventrals, shorter head and barbels, smaller eyes and fins, indistinct sexual dimorphism etc. This species

also resembles *Cobitis multifasciata* WAKIYA et MORI, a Korean species, in its shorter head and fins, but differs from it in the following points: body is not so compressed, its depth 7.1 in body length (8.5 in *C. multifasciata*); distance from the origin of dorsal to the base of caudal 2.5 in body length (2.75 in *C. multifasciata*); tail is longer (in *C. multifasciata* short); anal reaching half distance from its origin to the base of caudal (two-thirds in *C. multifasciata*); dorsal a little in front of ventrals (in *C. multifasciata* ventrals a little in front of dorsal); lower lip not divided so distinctly, and almost straight (in *C. multfasciata* divided distinctly and with two lobes); barbels 3 pairs and short (in *C. multifasciata* 4 pair and longer); eyes very small, its diameter 6.7 in head length (4.7 in *C. multifasciata*).

Suborder Silurina

Characters: Nematognathid fish with confluent parietals and supraoccipital. Four anterior vertebrae coossified, and with ossicula auditus or Weberian apparatus. No mesopterygium. Basis cranii and pterotic bone simple; no coronoid bone. Third superior pharyngeal bone wanting, or small and resting on the fourth; second directed backward. One or 2 pairs of basal branchihyals; 2 pairs of branchihyals. Suboperculum wanting, or modified into the upper branchiostegals. Mesocoracoid present. Premaxillae forming border of mouth above, except in one family, in which the maxillaries also bear teeth. Interclavicles present. No scales. Skin naked or with bony plates.

This group comprises 2 families *Siluridae* and *Bagridae* among Japanese fishes.

Key to Japanese families of Silurina

a[1] Dorsal fin without spine; base of anal fin long connected with caudal fin. Adipose fin not present. .... **Siluridae**

a[2] Dorsal fin with strong spine; caudal fin entirely separated from anal fin, biforked at end. Adipose fin present. .... **Bagridae**

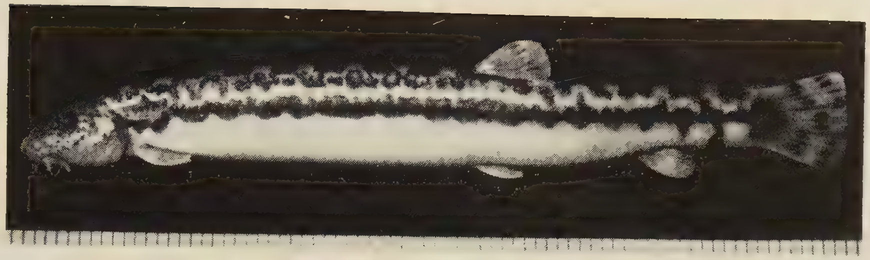
Family Siluridae

Characters: Body more or less elongate, strongly compressed, naked or covered with bony plates. No true scales. Head conical or with depressed snout, anterior part of head with 2 or more barbels, the base of the longest pair formed by premaxillaries only. Suboperculum absent; operculum present. Dorsal fin short usually present. Anterior rays of dorsal and pectoral fins usually spinous. No adipose fin. Ventrals small, rudimentary or absent, below or behind dorsal. Air bladder usually present, large, and connected with the organ of hearing by means of the auditory ossicles. Lower pharyngeals separate.

Genus Parasilurus BLEEKER, 1862.

Glanis AGASSIZ, 1856, Proc. Amer. Acad., p. 333.

Parasilurus BLEEKER, 1862, Versl. Med. Akad. Amsterdam, vol. 14, pp. 392, 394 (type:- *Silurus japonicus* SCHLEGEL).



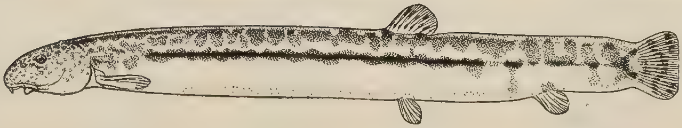
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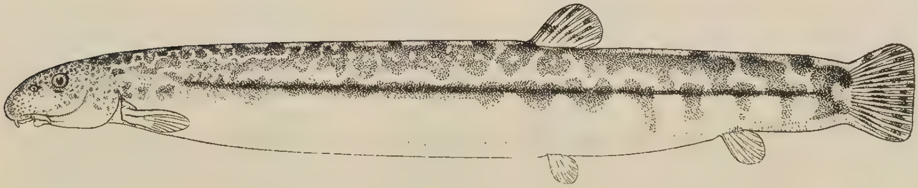
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4



5

1. ***Cobitis delicata*** Niwa, after H. Niwa. ♀
2. Ventral side of ***Cobitis delicata*** Niwa, after H. Niwa.
3. Spawning ground of ***Cobitis delicata*** Niwa, Gifu Prefecture, after M. Nakamura.
4. ***Cobitis delicata*** Niwa. ♂ ×1.5
5. ***Cobitis delicata*** Niwa. ♀ 1.5


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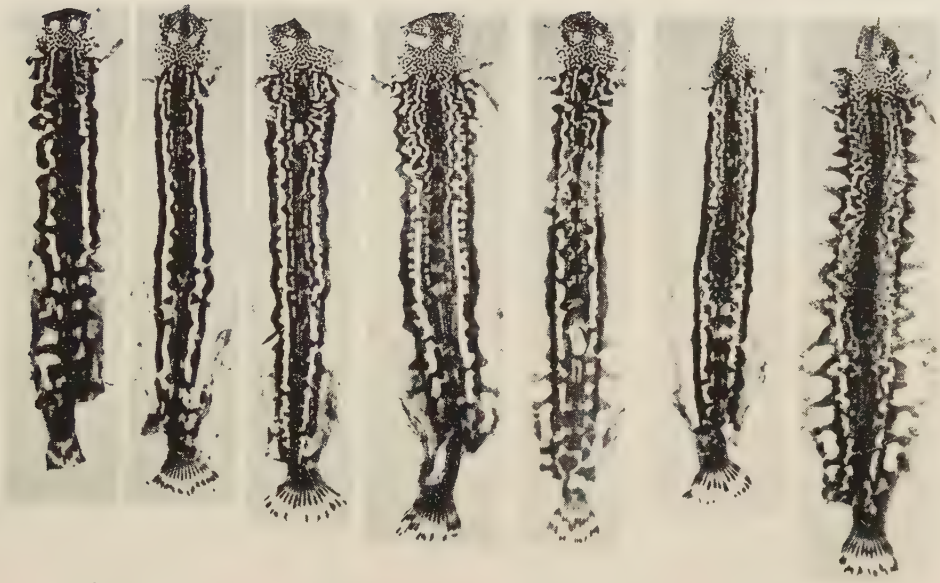
PLATE XLVII

Pattern variations of ***Cobitis delicata*** Niwa.

Cobitis delicata Niwa to show a pattern variatioas of many specimens obtained from the upper River Nagara of Gifu Prefecture.

1.	♂	XI	5	1948	8.	♀	XI	7	1948
2.	♂	XI	5	1948	9.	♀	XI	7	1948
3.	♀	XII	15	1948	10.	♀	XI	7	1948
4.	♂	XI	5	1948	11.	♀	XI	7	1948
5.	♀	XII	16	1948	12.	♀	XII	15	1948
6.	♀	XII	16	1948	13.	♀	XII	16	1948
7.	♀	XII	7	1948					

PLATE XLVII



1 2 3 4 5 6 7



8 9 10 11 12 13

Characters: Body elongate, the profile of the back almost horizontal, head depressed and covered with soft skin; eyes anterior and subcutaneous; mouth broad, transverse; barbels 4, two very long maxillaries and 2 short mandibles; teeth cardiform or villiform, in a transverse uninterrupted band on the vomer; no teeth on palatines. Gill opening wide, not confluent with the isthmus, narrowly joined together. Eye placed above the angle of the mouth, which is large. Dorsal fin small, without spines, and anterior; adipose fin absent; anal fin with 60 to 85 rays, contiguous or connectei with the caudal which is rnunded or truncate, very long; pectorals with spinals; ventrals behind dorsal. Air bladder not inclosed in bone. Freshwater Siluroids found in India, East Indies, China and Japan.

87. Parasilurus asotus (Linnaeus).
Mud-fish, Catfish, "Namazu"
(PL. XLVIII, figs. 1–7)

Silurus asotus Linne., 1578, Syst. Nat. Ed., x, p. 304. – Bloch et Schneider, 1801, Syst. Ichth., p. 378. – Basilewsky, 1855, Nouv. Mé. Soc. Nat. Mos., x, p. 240, pl. iii, fig. 4. – Günther, 1864, Cat. Fish. Brit. Mus., v, p. 33. – Kner, 1867, Novara, Fish, 3, p. 303, – Sauvage, 1993, Bull. Soc. Philomat., p. 2. – Steindachner, 1887, Denk. Match-Natureish. Kaiser. Akad. Wissensch., liii, p. 31. – Günther, Chall. Rep., p. 71. – Ishikawa, 1897, Prel. Cat., p. 23.

Parasilurus asotus Bleeker, 1873, Mem. Faun. Icht. Chin., N. T. Dierk., iv, p. 125. – Jordan et Snyder, 1901, Check List, p. 45. – Jordan et Fowler, 1903, Proc. U. S. N. M., vol. xxvi, no. 1338, pp. 903–304. – Tanaka, 1908, Ann. Zool. Jap., vol. 7, 1, p. 2. – Tanaka, 1909, Ann. Zool. Jap., vol. 7, 2, p. 128. – Jordan et Thompson, 1914, Mem. Carn. Mus., vol. iv, p. 213. – Berg, 1916, Les Poiss. des eaux douces de la Russie, pp. 362–363, fig. 282. – Tanaka, 1921, Nihon Gyogaku, p. 170, fig. 60. – Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. 10, p. 159. – Okada, Matsubara, et Uchida, 1935, Nihon Gyorui Zusetsu, pl. 24, p. 77. – Miyadi, 1935, Kyôtô Fuka no Tansuigyo, p. 15, pl. 3, fig. 8 – Ui, 1935, Kisyû Gyofu, pp. 27–28. – Ueno, 1935, Kamikochi oyobi Azusagawa Suikeino Suiseidobutsu, pp. 206–207, fig. 103. – Chevey et Lemasson, 1937, Cont. Poiss. Eaux douces Tonkinoises, pp. 101–102, pl. 30, fig. 66. – Okada, 1938, Cat. Vert. Japan. p. 137. – Okada et Ikeda, 1938, Saitô Hô-on Kai Mus. Res., Bull., no. 15, p. 107, textfig. 10. – Uchida, 1939, Bull. Fish. Exp. St., pp. 2–9, pl. 1, fig. 1–4, textfigs. 1–6. – Nichols, 1943, Freshwat. Fish China, p. 34. – Okada et Nakamura, 1948, Nihon no Tansui Gyorui, pp. 145–146, fig. 64. – Kamohara, 1950, Desc. Fish. Prov. Tosa & Kishû, Japan, p. 42, fig. 37. – Aoyagi, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 69–71, fig. 56.

Silurus punctatus Cantor, 1842, Ann. Mag. Nat. Hist., ix p. 485.

Silurus xanthosteus Richardson, 1844, Voy. Sulph. Fish, p. 133, pl. 56, figs. 12–14.

Silurus japonicus Temminck et Schlegel, 1846, Fauna Japonica Poiss.,p. 226, pl. civ, fig. 1. – Bleeker, 1853, Verhandel. Batavia Genootsch. Kunst. xxv, pp. 30, 51.

Silurus dahvricus Pallas, 1887, Nouv. Act. Akad. Petrop., I, p. 359, pl. xi, fig. 2.

Silurus befordi Regan, 1908, Proc. Zool. Soc. London, p. 61, pl. ii, fig. 3.

Glanis asotus Jordan et Evermann, 1902, Proc. U. S. Nat. Mus., vol. 25, no. 1289, p. 320, fig. 3.

The original description* is as follows:

Silurus. Caput nudum. Os cirris aliquot filiformibus tentaculatum Membr. branch. radius, ivxiv.

* C. Linnaeus, 1758, Systema Naturae, Tomus I, p. 304.

Corpus: Radius pinnarum pecto ralium aut dorsalis primus spinosus, retrodentatus.

Asotus. 1 S. pinna dorsali unica, cirris 4.
B. 16, D. 0/5, P. 1/14, V. 13, A. 82, C. 16.
Habitat in Asia. M. Ac. Holmenfis.
Cirri duo supra os; duo. nifra. Dentes numerosi.
Spina nulla rigida in pinna dorfi, at serrata in Pectoralibus, ut in congeneribus. P. ani longa, caudae ennexa.

Description: Head $4\,^3/_5$ in length, depth $5\,^7/_8$; D. 6; A. 78; P. 1, 13; V. 12; width of head two-thirds its length; eye about 9 in head; $2\,^1/_2$ in snout; 5 in interorbital space; pectoral $1\,^3/_4$ in head; ventral $2\,^1/_4$.

Body elongate, trunk deepest in front, compressed laterally, and tail long and tapering. Head moderate, broadly rounded and flattened; eyes small, lateral, and anterior; mouth very broad and superior; mandible projecting; teeth sharp, in broad villiform bands in jaws and on vomer and palatines; lips rather thin and smooth; nostrils rather far apart; barbels 4, 2 very long maxillaries and 2 snout mentals; interorbital space very broad, elevated, and flattened in middle. Gill-openings large, very narrowly jointed, and separate from very broad isthmus. Gill-rakers few and rather short; no pseudobranchiae. Body perfectly smooth and nake. Dorsal fin a little shorter than ventral fin and inserted just before tip of pectoral fin; anal fin base of very long, united with caudal fin behind, of uniform height, and its origin much before middle of length; pectoral spine stout, both edges with strong denticulations, and about three-fifths length of fin;

Table 94. Measurement of *Parasilurus asotus* LINNAEUS*.

Locality	Sex	Total length	No. Ray Dor. F.	No. Ray Pect. F.	Nos Ray Anal. F.	No. Vert.	B.L./B.H.	B.L./H.L.	H.L./S.L.	H.L./E.D.	H.L./I.S.	H.L./H.B.	H.L./L.P.S.
Shajô Rakutôkô, Korea	♂	212.0mm.	5	1.12	71	60	5.4	4.3	4.6	8.8	2.0	1.4	3.0
——	♀	200.0	5	1.12	73	60	6.1	4.1	4.7	9.5	2.1	1.5	3.3
——	♂	212.0	5	1.13	76	61	5.7	4.1	4.6	9.2	2.0	1.4	3.0
——	♀	346.0	4	1.12	83	63	5.8	4.2	4.7	10.4	2.0	1.4	3.2
Heijô, Korea	♀	284.0	5	1.12	83	63	6.4	4.4	4.3	11.5	2.2	1.3	2.8
——	♀	310.0	5	1.12	79	63	6.4	4.5	4.6	10.1	2.1	1.3	3.3
——	♀	326.0	5	1.12	84	60	6.0	4.1	4.9	11.5	2.3	1.3	3.2
Suigen, Korea	♂	369.0	5	1.13	85	62	6.1	4.4	4.4	10.7	2.3	1.4	3.2
Kôshin, Korea	♀	381.0	4	1.12	75	63	6.7	4.5	5.0	9.3	2.1	1.3	3.2
Suigen, Korea		395.0	5	1.12	79	63	5.2	4.1	4.7	11.3	2.4	1.4	3.0

*The measurements were made by K. UCHIDA from the specimens collected in Korea during 1923–1936.

pectoral fins not reaching ventral fins, which are shorter and reach beyond origin of anal fin; caudal slightly emarginate, lobes distinctly rounded and the upper projecting a little. Lateral line present. Anal papilla present. Color in alcohol, brown, middle of back darker; lower surface of head and abdomen whitish. Length 3 cm.

Color in fresh somewhat variable. The gound color dark brown or green yellow brown on the back and laterals. Irregular patterns may or may not be present on the body. Head and belly light yellow, light grey or white. Dorsal, caudal and anal fins nearly the same color of the body, margined with black. In some individuals, the outer margin of the anal fin light colored, and ventral fin dark along the dorsal margin. The margin of the pectoral fin light; dark inside.

Habits: The present species may mature in two years after hatching, and continue the spawning annually during 4–5 years. The number of depositing eggs is about 14,000 in an adult measured 300 mm. of body length. The breeding season around Tôkyô ranges from May to July and the best period occurs in the rainy season. The eggs are deposited on the stems of water plants as *Vallisneria* and *Hydrilla*. They are attached on them by individuals, not forming an egg mass. Eggs are cubical, light green, covered with gelatinous substance and measured 5–5.5 mm. in diameter. The eggs hatch out in 8–10 days after fertilization, under the water temperature of 17°–24°C. The just hatching out larva is much shrunk, measured 3.5–4.3 mm. in body length and provided with 3 pairs of barbels. Yolk is absorbed entirely 8 days after the hatching. When the young grows up 8.5 mm. in body length, another barbel appears posteriorly on the former barbels. All the barbels will develop until the youngs grow up to have 30–40 mm. body length, but when the youngs grow larger than 45 mm. in body length, the last barbels gradually shrink and all the remainings are entirely absorbed within the body of 90–100 mm. The present species likes to live in the warmer, stagnant waters and is very active at night in searching food. The present species lives on the sandymud beds of ponds, swamps and below the sluggish currents of rivers. Nocternal, active at night in search of food. Omnivorous, catching of all kinds of small animals and other kinds of fish. Many cases of parasitization by Nematods in the peritoneum are found in the species.

Breeding: The eggs are deposited separately on weeds or sandy mud bottom of shallow water of swamps. They have a transparent gelatinous envelope on the outside of the green yolk. The larva just hatching out has 4 mm. body length and origin of three pairs of barbels. Yolk sac observed after 8th days of hatching. In this period, the larva measured 8.4 mm. in body length; provided with one pair of barbels just-posterior from the other two pairs. This third pair of barbels is well-developed in the larva of 3 cm. body length. After that time, this barbel gradually atrophies and is cast off in the larva of 6–7 cm. body length. The facts above mentioned were observed by K. Atoda[1)2)] & Numazaki at Ogawara Numa and vicinity.

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1). Atoda, K., 1935, Zool. Mag., Vol. 47, No. 558, pp. 228–230.
2). Atoda, K., 1935, Sci. Rep. Tôhoku Imp. Univ., 4th Ser., Biol., Vol. 10, No. 1, pp. 29–32.

Development: The larval development of *Parasilus asotus* has not yet been completely studied in Japan. Here we mention several larval stages described by ATODA[1)] from the specimens collected at Ogawa Swamp, Numazaki, Aomori Prefecture, and by K. UCHIDA from the Korean specimens. Larva just hatching out has a large yolk sac and is very active, swimming on the bottom or gathering among weeds. The black body measured 4 mm. in length, provided with a yolk sac of 1.1 mm. in diameter. The mouth small, shallow, with undeveloped lower jaw; eye with few black pigments; nostrils open somewhat anteriorly. Myotomes appear and anlage of pectoral fins distinct. One pair of upper jaw barbels appear on outside of eye, while the lower jaw barbels developed start development as small buds; the chin barbels existing only in the larval stage. Larva just prior to hatching, slender; semitransparent; measured 4.3 mm. body length, head small curved on yolk sac; eye vesicle very small; vent opens near the middle of the body; yolk spherical; the anlages of lower jaw barbels appear on both sides of head end; myotomes not yet well-developed, chromatophores not present.

Larva just 2 days after (PL. XLIX, fig. 4) hatching measured 5.8 mm. in body length, provided with black pigments, excepting on the ventral side of the yolk sac; eye black; every barbel somewhat developed; caudal and anal fin anlages appeared.

Juvenile after three days measured 8.3 mm. (PL. XLIX, fig. 5) in body length; head somewhat flattened; body compressed, slender, anus opens at a position $^2/_5$ of the body length from anterior end of body; mouth large, opened on head end; the lower jaw slightly projected anteriorly from the upper jaw. Larval dorsal membranous fin begins just behind the head and gradually broaders posteriorly, and is broadest at the anterior part of the notochordal end, narrow and pointed at caudal end. Yolk sac still preserved. Myotomes $15+49=64$ narrower posteriorly in breadth. Eye small, situated obliquely upward on the middle of the side of the head; nosrils elongate, not yet separated. The upper jaw barbel situated somewhat anteriorly on the jaw angle, one pair of lower jaw barbels somewhat separated from each other, situated just below the eye, temporalily appears and is cast off in late younger stages; these barbels are provided with small cutaneous tubercles on the surface.

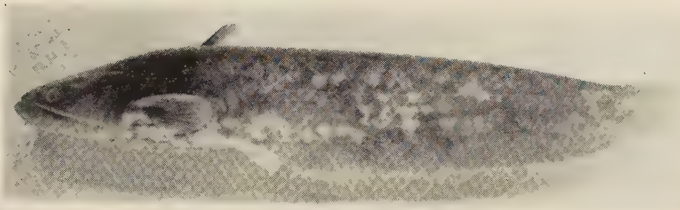
Body light brown, somewhat deeper on head; brown chromatophores scattered on the dorsal and ventral fins, without chromatophores along the outer margin of the caudal ventral membranous fin, eye vesicle blackish-brown.

Juvenile just 2 days after hatching measured 5.8 mm. in body length, provided with black pigments excepting on the ventral side of the yolk sac; young 8 days after hatching, observed with yolk sac, measured 8.4 mm. in body length; lower jaw present; barbels well-developed; the lower jaw barbels rather developed than the upper.

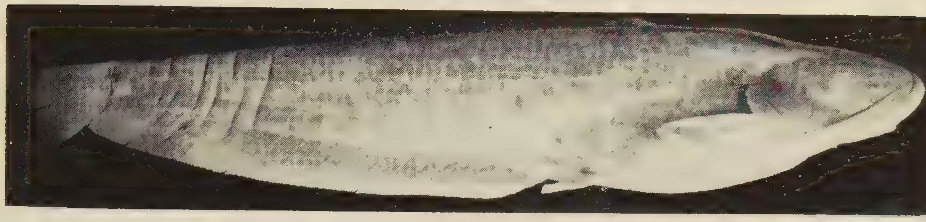
Juvenile[1)] of 2 cm. body length have well developed lower jaw barbels and all fins are distinct.

Juvenile[2)] of 3 cm. body length have well developed lower jaw barbels somewhat

1, 2). These specimens were described by K. ATODA in 1935, Zool. Mag., vol. 47, no. 558, pp. 228-230, figs. 1-5.



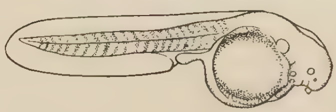
1



2



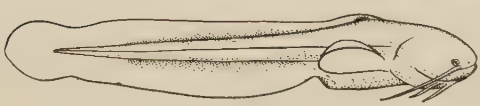
3



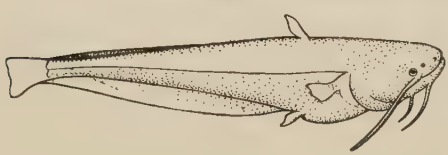
4



5



6



7

1. ***Parasilurus asotus*** (LINNAEUS). × 2/3
2. ***Parasilurus asotus*** (LINNAEUS). × 1/2
3. ***Parasilurus asotus*** (LINNAEUS). × 1
4. Larva jush after hatched, 4mm. long.
5. Larva 34 hours after hatched, 5.8 mm. long.
6. Juvenile 8 days after hatched, 8.4 mm. long.
7. Young of 5.1mm. long. after K. ATODA (1935)

longer or nearly equal to the upper jaw barbels.

Juvenile of 43.5 mm. body length are provided with one pair of weak barbels on the outer side of the chin. The body somewhat shorter; its length about $3\,^1/_5$ times of head length; the dorsal fin well-developed with 4 rays distinct, the longest one measured about three times the eye-diameter. The rays of the anal fin 75 in number. The relation betwen the disappearance of the third barbel and the body length varies with individuals, generally the maximum limit of body length when the third barbel disappears may be 113 mm.

Juvenile of 4.5 cm. or larger in body length have very weak, slender chin barbels. In the juvenile of 6–7 cm. body length, the chin barbels are naturally observed shedding, and 8 cm. or larger juvenile are quite lacking the chin barbel.

Rate of growth: This is quite dependent upon the living area and on the amount of food, and is rather variable with the environment. It is moderately possible that this species can grow 100–120 mm. body length in one year.

Table 95. The length of each barbel in the embryos of *Parasilurus asotus* provided with 3 pairs of barbels.*

Left side				*Right side*		
Upper jaw barbel	Chin barbel	Temporary barbel	Body Total length of Fish	Temporary barbel	Chin barbel	Upper jaw barbel
22.0mm.	8.0mm.	7.0mm.	58mm.	6.5mm.	7.5mm.	19.0mm.
23.5	11.5	4.5	70	5.0	9.3	24.0
25.5	10.2	vestiges	80	not	9.5	26.0
27.5	9.0	6.7	83	8.5	11.5	26.0
27.7	11.0	7.0	88	6.0	11.2	25.0
29.3	11.2	5.2	92	2.8	12.0	29.2
28.5	10.9	5.0	93	5.9	10.9	27.2
25.5	10.7	vestiges	94	4.0	10.3	28.0
35.8	13.5	6.5	(88)*	7.0	15.1	39.0
31.3	12.2	vestiges	105	1.0	12.2	31.0
32.5	14.7	not	105	4.5	14.5	32.5
41.0	14.8	vestiges	113	vestiges	14.8	41.5

*These measurements were made by K. UCHIDA 1939, from the Korean specimens.

Distribution: The present species is ditsributed widely from south Honshû to Formosa. Ichiyanagi Numa, Aomori Prefecture (AOYAGI); River Yonadai, Akita Prefecture (IDE). Aomori City; River Iwaki (introduced from Kôchi Prefecture in 1887. Mentioned by NARITA 1935). Okayama; River Tama; Lake Biwa (JORDAN & THOMPSON); Kumamoto (WAKIYA); Ôzu (WAKIYA); Himaezi (ABE); Nagano (NAKANO); Lake Suwa (OTA); Lakes Suwa & Hakone (JORDAN); Fukuoka (HAMADA); River Hino, Lake Kasumigaura (HATTORI); Tôkyô (OTAKI); Niigata, Sendai, Morioka, Ichinoseki, River Tama, River Chikugo, Kawatana, Tsuchiura, Lake Biwa, Matsubara, Formora (JORDAN & FOWLER); Okayama, River Tama, Lake Biva (JORDAN & THOMPSON); Pechili, China (BASILEWSKY); Lake Hakou (GUNTHER); Yokohama, Lake Biwa (JORDAN & SNYDER); Tokiwa, Lake Biwa, Shinano, Nagano Prefecture (TANAKA); Higo Satsuma,

Nagasaki (TEMMINCK & SCHLEGEL); Lake Biwa (JORDAN & SNYDER); Noshiro Yamamoto, Hachirogata, Hunagoshi, Minamiakita-gun; Yokote, Akita Prefecture; Aomori, Denko-numa, Nishitsugaru-gun, Aomori Prefecture; River Kitakami, Morioka, River Shizuishi Iwate-gun, Zyanoshima Morioka, Iwate Prefecture; River Dezuka Wakuya Toda-gun, Hoshun in Senda, River Okada, Shichigo, Nishitaga Senidai, Miyagi Prefecture; Uchi River Tsuruoka, Tsuruoka, River Niida, Yamagata Prefecture; Kitakaya Yama-gun, Fukushima Prefecture (OKADA & IKEDA); Tadaimura, Miyatsu, Kyôto; (Zeze, Kyôto; Lake Suwa, Nagano Prefecture (O. H. S.)*; River Yoneshiro, Akita Prefecture (AOYAGI & IDE); River Zyôro, Kitami Prov., Hokkaidô (AOYAGI); River Iwaki, Aomori Prefecture; Aomori City, Aomori Prefecture (AOYAGI).

Remarks: SH. TANAKA (1936) acknowledged the present species as a subspecies of *Silurus glanis* (LINNAEUS) of Europe. It is an interesting fact that the present species is not as yet known from Hokkaidô, in spite of being rather abundant in Aomori Prefecture, the northernmost part of this district. MIYAGI** mentioned an albino of the species rarely found in Kyôtofu, the middle of Honshû, Japan.

Family Bagridae

Characters: Body more or less elongate and naked. Front of head with pairs of barbels (nasal maxillary, mandibularly, and mental), of which the maxillary pairs may in some species extend to or on the caudal fin; posterior nostrils well separated from the anterior and having a nasal papillae on their margin; jaw teeth viliform in bands, vomero-palatine teeth in a single oval patch or in a curved band; gill membranes free from the isthmus and either united to or separated from each other; marked development of the adipose fin, which in some species may be nearly half the standard length of the fish; dorsal fin arising in advance of the ventrals, with a pungent spine serrated or smooth on its posterior side and with 6 or 7 branched rays; and caudal fin well-developed and forked or not. Four genera *Pelteobagrus*, *Pseudobagrus*, *Liobagrus* and *Coreobagrus* found in Japan.

Key to the Japanese genera of Bagridae

a¹. Adipose fin somewhat adnate, free behind; mental barbels as usual, the median pair not notably distant.

b¹. Caudal fin deeply forked; upper surface of head bony and granulated, the skin covering the bones being very thin. .... **Pelteobagrus**

b². Caudal fin subtruncate; upper surface of head covered with thick smooth skin, concealing the bones.

c¹. Body short; anal very short with 13–16 rays. .... **Coreobagrus**

c². Body somewhat elongate; anal rather long with 18–23 rays. .... **Pseudobagrus**

* O.H.S. …… Ôtsu Hydrobiological Station attached to Kyôto University.
** MIYAGI, 1935, p. 15.

a². Adipose fin adnate to the back and connected with the caudal; caudal rounded; median mental barbels far apart; body elongate; head small, smooth above; dorsal well forward .... **Liobagrus**

Genus **Pseudobagrus** Bleeker, 1860.

Pseudobagrus Bleeker, 1860, Act. Soc. Sci. Indo-Nederl., vii, p. 87.

Characters: Body moderately elongate. Head broad and depressed, covered above by moderately thick, smooth skin; eyes moderate or rather small; snout broad, obtuse; transverse, and with bands of villiform teeth in the jaws; a continuous transverse band of teeth on the roof of the mouth; nostrils remote, the anterior usually in a small tube; 8 barbels, the maxillaries the longest, and the mentals more or less evenly distributed. Dorsal fin short, with 5 to 7 rays, and like the pectoral with a stout spine; caudal rounded or subtruncate; anal with 20 or more radii; ventrals broad, with 6 rays.

88. **Pseudobagrus aurantiacus** (Temminck et Schlegel).
"Gigi, Gibati"
(PL. XLIX, figs. 1–5; Text-figs. 94. a-c)

Bagrus aurantiacus Temminck et Schlegel, 1884, Faun. Japon. Poiss., p. 227, pl. civ, fig. 2.

Pseudobagcus aurantiacus Bleeker, 18, Act. Soc. Sci. Indo-Nederl., vii, p. 85. - Sauvage, 1883, Bull. Soc. Philomat., p. 2. – Günther, 1864, Cat. Fish. Brit. Mus., p. 85. – Ishikawa, 1897, Prel. Cat., p. 22. – Jordan et Snyder, 1901, Annot. Zool. Japan, iii, p. 44. – Jordan et Fowler, 1903, Proc. U. S. N. Mus., vol. xxvi, no. 1338, pp. 906-907. – Tanaka, 1908, Ann. Zool. Jap., vol. 7, pt. 1, p. 11. – Jordan et Thompson, 1914, Mem. Carn. Mus., vol. vi, no. 4, p. 214. – Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 159. - Tanaka, 1921, Nihon Gyogaku, p. 171. – Okada, Uchida, Matsubara, 1935, Nihon Gyorui Zusetsu, p. 78, pl. 24, fig. 4. – Okada et Ikeda, 1938, Saitô Hô-on Kai Mus., Re. Bull. no. 15, p. 108, text-figs. 11-12. – Okada et Nakamura, 1948, Nihon no Tansuigyo, p. 147, fig. 66. - Aoyagi, 1957, Gen. Notes Fresh. Wat. Fish, Jap. Arch., pp. 72–73, fig. 57.

Pseudobagrus tokiensis Doderlein, 1887, Fische Japans, iv, p. 288. - Steindachner, 1887, Denk. Math. & Naturw. Classe Kaiser. Akad. Wiss. Wien, p. 32. – Jordan et Snyder, 1901, Annot. Zool. Japan, ii, p. 45.

Pseudobagrus ransonnettii Steindachner, 1887, Denk. Math. & Naturw. Classe Kaiser. Akad. Wiss. Wien, liii, pp. 31–32.

The original description* is as follows:

Les Bargres (*Bagrus*)

Bagrus aurantiacus, Pl. civ, fig. 2. Cette espèce nouvelle se reconnait à sa dorsale adipeuse assez longue, à son anale de grandeur moyenne, à sa tête couverte comme le reste du corps d'une peau nue, et à ses teintes. Elle appartient au nombre de celles qui ont la tête garnie de huit barbillons, et tient

* Temminck et Schlegel, 1884, Fauna Japon. Poiss., p. 227, pl· civ, fig. 2.

par les proportions de son adipeuse et de son anale, en quelque sorte le milieu entre les espèces des deux premières sub-divisions établies par Mr. de VALENCIENNES dans le genre Hagre; voir l'ouvrage de cet auteur, tome 14, p. 389 et 396.

La longueur de la tête entre environ cinq fois dans la longueur totale de ce poisson. La tête est deprimée, un peu arrondie au sommet et sa ligne supérieure forme une courbure assez légère. Les yeux, tant soit peu dirigés vers le haut, sont peut grands; leur intervalle, à peu près quatre fois plus considérable que leur diamèfre, égale presque la moitié de la longueur de la tête. La mâchoire supérieure dépasse l'inferieure; chacune d'entre elles est armée d'une bande assez large de dents en velours; il existe une bande semblable, mais moins large, sur le vomer. Les barbillons supérieurs naissent immédiatement au devant des narines, un peu plus près des yeux que de l'extrémité du museau; leur intervalle est un peu plus considérable que la moitié de celui des yeux; leur longueur égale presque deux tiers de la longueur de la tête. La deuxième paire de barbillons nait derrière le bord de la lèvre supérieure, sur la ligne du bord inferieur de l'aeil; ces barbillons sont plus longsque les supérieurs, et atteignent l'angle supérieur des ouies. Les quatre barbillons de la mâchoire inférieure naissent derrière la levre; ils sont rapprochés deux à deux, et l'intervalle des deux mitoyens égale environ le diamètre de l'aeil; les externes égalent en longueur les barbillons supérieurs, les internes sont plus courts que ceux-ci. La peau de ce poisson offre une surface nue et unie; mais les téguments de la tête sont finement granulées. Les os de l'ép ule et du bras sortent de la peau, et ce dernier forme au-dessus de l'épine des pectorales, une pointe triangulaire assez longue. La ligne latérale est droite et un peu plus rapprochée de celle du ventre. L'anus s'ouvre à peu près sur le milieu de la ligne inférieure du poisson.

La dorsale nait vis-à-vis de la pointe de l'os du bras; lahauteur égale à peu près celle du tronc; son premier rayon est transformé en une épine assez vigoureuse et à surface âpre. Les pectorales sont un peu moins longues que la dorsale; l'épine, dont elle est armée, est assez forte, à surface couverte d'aspérités et à bord posterieur fortement dentelé. Les ventrales sont petites et pointues; couchées en arrière, elles atteignent avec leur extrémité la base de l'anale. Cette dernière nageoire occupe plus de la moitie de la queue; sa hauteur égale la moitié du diamètre vertical du tronc aux pectorales. La dorsale adipeuse correspond par son étendue à l'anale, mais elle est un peu plus basse et un peu plus reculée vers le devant. La caudale est peu développée et arrondie à l'extrémité. B. 8; D. 1+6; A. 20; V. 6; P. 1+5; C. 20.

La teinte du fond est, à l'etat frais, un jaune orangé peu vif, nuancé de vert audessus des pectorales et de vert brunatre sur les nageoires. Les pectorales et les parties inférieures de la tête tirent au rougeâtre. Les autres parties de la tête sont d'un vers olivâtre foncé et sale.

On pêche ce poisson, qui n'atteint que cinq à six pouces de longueur, de temps en temps, dans les grands fleuves des districts de Satzuma, Kuruma, Higo etc.; sa chair, que l'on ne mange jamais, est même réputé venimeuse. On désigne ce poisson au Japon sous le nom de Kigikjoo.

Description: Head, $5\,^1/_5$ in length; depth, 7; D. I, 7; A. 20; P. I, 7; V. 6; eye, $4\,^1/_2$ in interorbital space; width of mouth, 2 in head; pectoral, $1\,^1/_2$ in head; ventral 2. Body elongate, with rather uniform depth, the tail strongly compressed. Head broad, depressed; snout short, bluntly rounded when viewed from above and projecting beyond mandible; width of head is less than its length; eyes small, laterally superior, and covered with thin skin; jaws with broad bands of villiform teeth, also on palate in a broad transverse band; lips moderately thick and slightly papillose; nasal end median mental barbels about equal, about half length of maxillary pair, which latter are much longer than outer mentals, though considerably shorter than length of head; mental barbels are all rather evenly distributed, in median pair slightly farther apart than either is from outer, interorbital space is broad, elevated, and flattened; anterior nostrils tubular and in a shallow pit. Gill openings large, the gill membrane deeply notched

and forming a free fold across isthmus; broad. Gill rakers narrow, 3 + 7. Body smooth; top of the head smooth; humeral process finely granular. Origin of dorsal, above tip of

Table 96. Measurements of *Pseudobagrus aurantiacus* (Temminck et Schlegel).

Collection	O. H. B. S.*		
Total length	84.0mm.	78.0mm.	166.0mm.
Body length	71.0	67.0	142.0
Body length/Head	3.73	3.83	3.94
Body length/Depth	5.68	5.36	5.12
Body length/Predorsal length	2.84	2.79	2.96
Body length/Prepectoral length	3.84	3.94	4.18
Body length/Preventral length	1.95	1.97	2.12
Body length/Preanal length	1.61	1.54	1.63
Head/Snout	3.80	3.50	2.88
Head/Upper jaw			
Head/Interorbital width	2.26	2.50	2.40
Head/Diameter of Eye	5.42	5.15	9.47
Head/Length of Caudal peduncle	2.29	1.95	1.41
Head/Depth of Caudal peduncle	2.72	2.50	2.35
Head/Length of Dorsal fin	2.92	2.40	3.00
Head/Length of Anal fin	1.31	1.30	1.18
Head/Height of Dorsal fin	1.73	1.52	1.71
Head/Height of Anal fin	3.65	3.50	3.13
Head/Pectoral length	1.52	1.46	1.76
Head/Ventral length	1.90	1.70	2.18
Date	1929		XI, 1915
Locality	Yanagawa, Fukuoka Prefecture		Kasumigaura Ibaraki Pref.

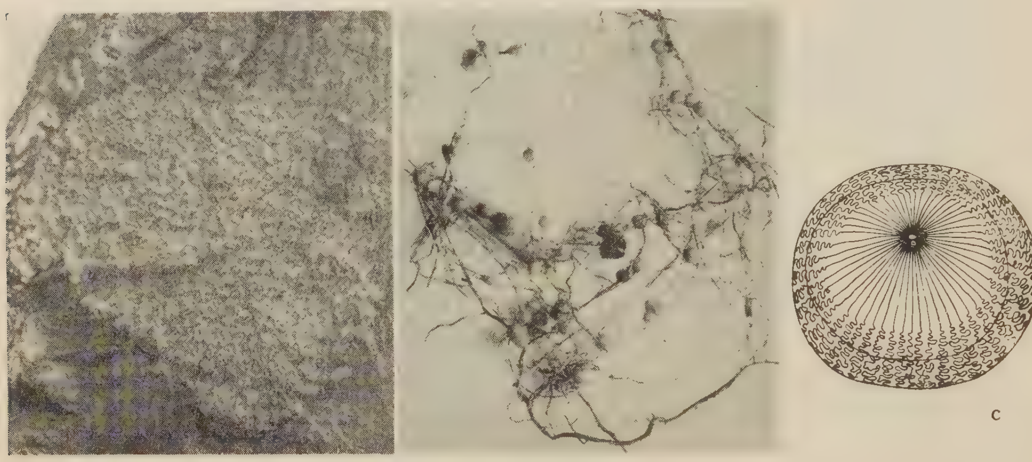
* Ôtsu Hydrobiological Station attached to Kyôtô University.

pectoral, its spine sharp and half length of dorsal; anal base rather long; caudal truncate, its edge rounded, very slightly emaginate, and with two lobes rounded, upper slightly longer; adipose dorsal much shorter than anal and ending before tip of anal; pectoral with robust roughened spine, inner edge with large teeth, falling short of end of fin; ventral broad, behind dorsal and reaching almost to origin of anal. Anal papilla well-developed. Lateral line well developed and superior in front; head with a number of pores. Clour brown, dark above, clouded with deep brown, the abdomen and lower surface of head pale or whitish. Total length $9\,^1/_2$ inches.

Type locallty: Satuma, Kurume, Higo.

Habits: The Japanese bullhead, *Pseudobagrus aurantiacus* is restricted to the sheltered bays of the lakes, the sluggish streams and ponds of the North-Eastern Honshû in Japan. Around Tôkyô, the breeding season occurs during June and July. The eggs are deposited on water plants or under stones of shallow waters and streams. The eggs hatch out 3–4 days after fertilization, under the water temperature of 27°C. The just hatching out larva measures 6.2 mm. in body length. The youngs grow in a streams during summer, they winter in the depths of a large river in the end of autumn and ascend again into a stream when the river flows next spring. Aoyagi mentioned in his book

(General Notes on the Freshwater Fishes of the Japanese Archipelago, 1957), that he observed on early morning in the middle of April, a school of the youngs measured 65–70 mm. body length ascending into a stream, emptied into River Sendai, around Yuta, Miyanojô Machi, Satsuma-gun, Kagoshima Prefecture. This fish is very active at night and likes to gather on sandy bottom.



a b

Text-figs. 94. a. Egg-mass of ***Pseudobagrus aurantiacus*** (T. et SCH.). ×1 deposited under a stone.
b. Eggs of ***Pseudobagrus aurantiacus*** (T. et SCH.). ×1 attached to roots of plant.
c. Egg of ***Pseudobagrus aurantiacus*** (T. et SCH.).

Development: Egg: The eggs are yellow (Text-fig. 92, c), 2.29×2.27 mm. in diameter. Egg-masses (Text-fig. 92, a–b) adhere tightly to stones or under the submerged wood of shallow waters. Incubation lasts from 3–4 days at water temperature of 27°C.

Larva: Newly hatched larva (Pl. 50 fig. 3), total length, 6.20 mm; myomeres 16 to vent plus 22 behind, with a large spherical yellow yolk sac. Two pairs of very large barbels, and pectoral bases appear. Pigmentation: The small black pigment appears almost all over the entire body except on the yolk sac and marginal fin fold.

Juvenile of 20–hours old: Pectoral fin fold developed, 3 pairs of barbels, (one very large on upper jaw), notochord turned slightly upward. Pigmentation is essentially same as in the previous stage. The eye is wholly pigmented in deep black. The top of head is thickly covered with black pigment.

Juvenile of 3 days old: At this time it is about 8.0 mm. in total length. The head is compressed horizontally; maxillary barbel is as long as the head length, and the caudal fin rays are beginning to develop in the truncated tail. Dorsal fin is separating from the marginal fin fold. The young is nearly black and looks like a tadpole of frog. The black pigment is distributed over the entire body except on the ventral side of the yolk

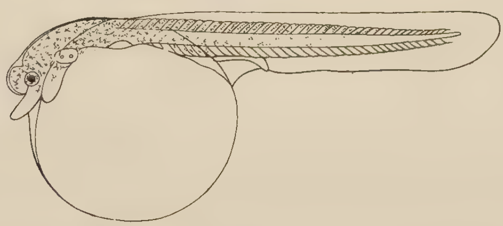
PLATE XLIX



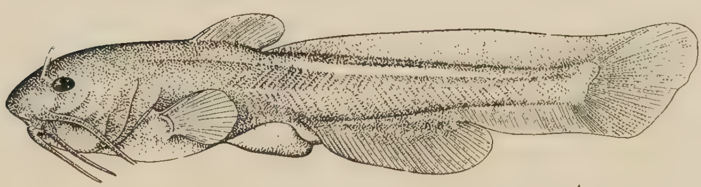
1



2



3



4



5

1. ***Pseudobagrus aurantiacus*** (TEMMINCK et SCHLEGEL). ×⅔
2. ***Pseudobagrus aurantiacus*** (TEMMINCK et SCHLEGEL). ×1.5
3. Larva of ***Pseudobagrus aurantiacus*** just aftr hatched, 6.2 mm. long.
4. Young of 10.45 mm.long.
5. Young of 13 mm. long.

sac, sense organs such as lateral line of the body and on the head.

Juvenile with 10.4 mm. body length (PL. L, fig. 4): Total length, 10.45 mm.; body length, 8.60 mm.; body height, 2.11 mm.; head length, 2.05 mm.; diameter of eye, 0.31 mm.; snout length, 0.82 mm. Body rather elongated at posterior portion; head heavy and stout with four pairs of long barbels. Marginal fin fold of dorsal to back in its posterior margin, separated from caudal fin by an incomplete ventral. Rays developed in the truncated caudal fin and in the ventral, but incompletely developed in dorsal and pectoral. Except for the abdominal region of posterior portion of the body, the body is entirely coloured with black.

Juvenile with 13.0 mm. body length (PL. L, fig. 5): Total length, 13.00 mm.; body length, 10.65 mm.; body height, 2.85 mm.; head length, 3.08 mm.; diameter of eye, 0.52 mm.; snout length, 1.00 mm. Body stout; all the fins well formed; adipose fin developed separating from caudal. The young fish of this stage presents nearly the same characters as the adult. Pigmentation at this stage is equal to the previous stage, but the black pigment is fainter at the posterior portion of head forming a neck ring.

Breeding: The Japanese Bullhead is a summer breeder, seeking the aquatic weeds or under large stones of quiet shallow waters. K. UCHIDA has recorded the life history of the Korean Bullhead, *Liobagrus reini*, and mentions peculiar breeding habits, in that the males guard their eggs. But in the Japanese Bullhead, such breeding habits have not been well observed.

Food habits: Eighteen specimens of 13 to 15 mm. in total length were dissected. The fishes in the first stage of about 13 to 14 mm. in size, chiefly feed upon *Cyclops*, larvae of *Simulidae* and occasionally *Tanypus* larvae. There are found in the shade of the aquatic plants or stones in shallow waters. At the young stage, the feeding habits change to a true mud feeder as it natural food consist almosts wholly the larvae and pupae of aquatic insects as *Chironomidae*, *Ephemeridae*, *Hydropsychidae*, as well as small fishes.

Distribution: Tôkyô (JORDAN & THOMPSON); Fukuoka, Kyûshû (JORDAN & HUBBS); Lake Biwa (SAUVAGE); River Kitakami; Tôkyô; River Kinu, Utsunomiya; River Tama, Tachikawa; Tsuchiura; River Kitakami, Morioka (JORDAN & FOWLER); Satuma, Kurume, Higo (TEMMINCK, SCHLEGEL); Suwa, Tôkyô, Chichibu, Lake Tega (ISHIKAWA); Tôkyô (DODERLEIN); Lake Biwa (TANAKA); Akita Prefecture; Iwate Prefecture; Miyagi Prefecture (OKADA & IKEDA); River Yana, Fukuoka Prefecture (KINOSHITA); Kasumigaura, Ibaraki Prefecture (O. H. S.)[1]; River Mabuchi, Aomori Prefecture (AOYAGI); River Sagami (TANAKA); River Yonadai, Akita Prefecture (AOYGI & IDE); Yamagata Prefecture; Niigata Prefecture; Kuzuryu River, Fukui Prefecture (KATO); Nagasaki (TEMMINCK & SCHLEGEL); Araki Bay; the coast of Yashiro Sea; River Katsuke, Kagoshima (OGAWA).

Remarks: MIYADI[2] mentioned that the distribution of the species is not extending

1). O.H.S. Ôtsu Hydrobiological Station attached to Kyôto University.
2). MIYADI, 1935, p. 15. 15

to south-western part of Honshû, only limited in the region of north-eastern. But the author and NAKAMURA[1] have found the present species showing a discontinous distribution in Japan. They found the species in south-northern part of Kyûshû and the north of Kantô district in Honshû, and now in question where the mixtured area between this species and *Pelteobagrus nudiceps*. JORDANN et SNYDER[2] took *Pseudobagrus tokiensis* of DODERLEIN under the synonyme of the present species, as the main characters in which it was supposed of differ do not seem to de tangible.

Genus **Coreobagrus** MORI, 1936.

Coreobagrus, MORI, 1936, Zool. Mag., 48, p. 672.

Characters: Moderate or small sized cat-fishes, with short trunk than the case of *Pseudobagrus* BLEEKER. Mouth transverse; upper jaw generally the longer; gill openings wide, the gill membranes well developed, overlapping the isthmus and separated at the chin. Eye large, the diameter 4.0 to 7.0 in the length of head, orbital rim with imperfect eyelid. Barbels eight, one nasal, one maxillary, and two mandibular pairs, maxillary pair reaches to the base of the pectoral fin. Rayed dorsal fin with one serrated strong spine and six to seven rays; adipose dorsal with its posterior margin free, not adnate to back with caudal fin; pectoral with one serrated strong spine and six rays; anal short with thirteen to seventeen rays (including rudiment); caudal slightly emarginated or incompletely biforked, and the outline of each lobe is obtuse in comparision with *Pelteobagrus* BLEEKER.

89. **Coreobagrus ichikawai** OKADA et KUBOTA.

"Gigimodoki, Kanpachi"

(Text-figs. 95, a–b)

Coreobagrus ichikawai, 1957, J. J. I., 5 (3–6), pp. 144–145, fig. 1.

The original description[3] is as follows:

Coreobagrus ichikawai

D. I, 7; A. I, 16 (14 to 16); P. I.6; V. 6.

Head 4.1 (3.8 to 4.1) in body length; depth 3.7 (3.7 to 4.1); width 5.3 (4.9 to 5.8); distance from snout to origin of dorsal 2.7 (2.6 to 2.7); that from snout to anus 1.7 (1.7 to 1.8); that from snout to origin of anal 1.6 (1.6); that from snout to origin of adipose fin 1.6 (1.6 to 1.7). Snout 3.3 (3.0 to 3.7) in head length; orbit 6.6 (6.2 to 6.8); interorbital space 1.9 (1.9 to 2.4); greatest width of head 1.1 (1.1 to 1.2). Depth of caudal peduncle 1.6 (1.6 to 1.7) in its length.

Body short and rather compressed, tapering from anterior portion of the dorsal to posterior of the

1). OKADA et NAKAMURA, 1948, p. 147.
2). JORDAN et SNYDER, 1900, Proc. U. S. N. M., vol. 26, p. 907.
3). OKADA et KUBOTA, 1957, J. J. I., 5 (3–6), pp. 144–145, fig. 1.

adipose fin, covered with very tensible and scaleless skin. Snout broad and depressed when viewed from above; upper jaw generally longer, and extending beyond transverse mouth; mouth half interior margin of eye; teeth uninterrupted with numerous villiform, crescentic band across the palate. Eye moderate size, superlateral, with imperfect eyelid. Interorbital space flat and broad with a shallow groove in the center; top of head covered with thin skin; upper surface of head, opercles and humeral processes with smooth ridges; occipital processes broad posteriorly and twice as long as wide at its base, a considerable interspace between it and the basal bone of the dorsal fin. Barbels four pairs, the nasal rather above half or shorter the length of head; maxillary pair extending beyond pectoral base; the mandibular pairs generally shorter than the others. Dorsal spine 2.7 (2.1 to 3.1) in head length, strong, anterior surface with smooth, serrated posteriorly; anterior rays longer than the spine, but posterior ones shorter. Adipose dorsal with a long base equalling about the interspace between the two dorsals, that with its posterior margin free and very low in front. Ventral reaching beyond anal base. Anal higher than adipose and its base shorter than the latter. Pectoral spine 1.7 (1.7 to 1.8) in head length, and same to dorsal. Caudal incompletely biforked with blunted lobes, but rather distinct on account of the overlapping of upper and lower lobes of this fin; upper lobe slightly the longer. Lateral line nearly straight, running along the middle of caudal peduncle. Gill membranes well developed, overlapping the isthmus and being separated at the chin. Scapular processes exposed, pointed extending three fifths of the length of pectoral spine. Colour in formalin yellowish; top of head, below dorsal and adipose, from reaching to end of dorsal to base of adipose, and caudal peduncle dark brownish grey; ventral surface of head and abdomen whitish; the fins somewhat brownish grey, but anal and ventral margin paler.



a



b

Text-figs. 95, a–b. ***Coreobagrus ichikawai*** OKADA et KUBOTA. ×1

Remarks: *Coreobagrus ichikawai* is distributed in a limited locality (River Miya, River Isuzu, and others) of South Ise, Mie Prefecture, Japan. Up to the present, the fishes assigned into this genus are only described one kind of short bodied cat-fish called *C. brevicorpus* from Korea by MORI (1936). *C. ichikawai* is obviously distinguished from

C. brevicorpus by its slightly longer body, smaller eye, and incompletely biforked caudal.
Type Locality: The River Miya, the River Isuzu, Mie Prefecture.

Genus **Pelteobagrus** BLEEKER, 1879.

Pelteobagrus P. BLEEKER, 1879, Poissons de Chine, p. 3.

Characters: Caudal deeply forked and the top of the head rough and granulated, the covering skin being very thin. Rays of anal 20–25. Adipose free behind. River of Japan and China.

90. **Pelteobagrus nudiceps** (SAUVAGE).
"Gigi, Hage-gigi"
(Text-figs. 96, a–c)

Pseudobagrus nudiceps SAUVAGE, 1883, Bull. Soc. Philom., p. 155. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch. pp. 73–75, figs. 58–60.
Fluvidraco nudiceps JORDAN et FOWLER, 1903, Proc. U. S. Nat. Mus., vol. XXVI, no. 1338, p. 906. TANAKA, 1908, Annot. Zool. Japon, vol. 7, pt. 1, p. 11. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., p. 213.
Pseudobagrus ransonnetii STEINDACHNER, 1887, Fische Japans, p. 287. – JORDAN et SNYDER, 1901, Annot. Zool. Japon., vol. 3, p. 44. – JORDAN et FOWLER, 1903, Proc. U. S. N. M., vol. XXVI, no. 1338, pp. 904–905, fig. 1.
Pelteobagrus nudiceps TANAKA, 1921, Nihon Gyogaku, p. 170, fig. 61. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, p. 159.
Fluvidraco ransonneti TANAKA, 1908, Annot. Zool. Japon., vol. 7, pt. 1, p. 11. – UI, 1932, Kisyû Gyofu, p. 26. – MIYADI, 1935, Kyôtofuka no Tansuigyo, p. 16, pl. 3, fig. 9, – OKADA, UCHIDA, MATSUBARA, 1935, Nihon Gyorui Zusetsu, p. 78, pl. 24, fig. 3. – UENO, 1935, Kamikôchi, Azusagawasuikei no Suisei Dôbutsu, p. 208. – KAMOHARA, 1950, Does. Fish. Prov. Tosa and Kishu, Japan., p. 41–42, fig. 36.

The original description* is as follows:

D. I, 6; A. 23; P. I, 7. Longueur de la tête contenue cinq fois dans la longueur totale. Dessus de la tête osseux; granuleux; processus occipital plus long que large, étroit; os basilaire triangulaire, aussi long que le processus occipital, partagé en deux par une suture transverse. Epine dorsale dentelée, aussi longue que la tête, sans le museau. Epine pectorale de même longueur que l'epine dorsale, très fortement dentelée. Adipeuse de même longueur que l'anale. Machoire superieur plus longue que l'inferieure; dents du palais disposées suivant une band retrecie au milieu. Barbillons maxillaires s'etendant jusqu'a la pectorale. Lonhueur, 0.090.
Sur une collection de poissons recueillie dans le Mé-Nam (Thai) par M. HARMAND.

Description: Head $4\,^1/_4$ in length; depth 6; D. I, 7; A. 20; P. I, 7; V. 6; width of head $2\,^1/_3$ in its length; eye 5 in head; $1\,^1/_2$ in snout; $2\,^1/_4$ in interorbital space; pectoral $1\,^1/_3$; ventral a little more than half the head.

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* SAUVAGE, 1883, Bull. Soc. Philomathique de Paris, Sept. Serie – Tome Sept., p. 155.

Body elongate, compressed. Head broad, depressed; snout broad, obtuse, depressed, and flattened above; eye moderate, anterior lateral, and more or less covered with skin of head; mouth very broad, transverse, and its width about $2\,^3/_4$ in head; teeth in broad villiform bands in jaws, and roof of mouth also with a broad transverse band; 8 barbels, nasals and median mentals about equal, shorter than outer mentals; which are not as long as the maxillaries, latter reaching beyond gill-openings, and all of mentals rather evenly distributed; lips moderately thick; interorbital space broad, flattened, and very slightly elevated; anterior nostrils tubular and in a shallow depression. Gill-opening large, membrane deeply notched and forming a free fold across isthmus; isthmus broad. Gill-rakers narrow, $3+9$. Body smooth, top of head smooth, occipital process and plate in front of spinous dorsal finely striate or granular; humeral process finely granular. Origin of dorsal in advance of tip of pectoral spine, its spine long, sharp, smooth, and shorter than the longest rays; base of anal long, and its origin nearer posterior margin of eye than tip of caudal; caudal shorter than head, deeply forked, lobes somewhat pointed, and upper longer; pectoral equal to head without snout; spine smooth, except


a


b


c

Text-figs. 96. ***Pelteobagrus nudiceps*** (SAUVAGE).
a. Young of ***Pelteobagrus nudiceps*** (SAUVAGE).
b. ***Pelteobagrus nudiceps*** (SAUVAGE).
c. ***Pelteobagrus nudiceps*** (SAUVAGE). ×1.5

along its posterior edge which is armed with strong recurved teeth; ventrals broad and reaching origin of anal; adipose fin long, though less than base of anal, and its posterior edge not adnate and not extending beyond posterior tip of anal, its form much as in *Ameiurus*. Anal papilla developed. Lateral line present. Color brown, darker above, abdomen and lower surface of head pale or whitish; edges of dorsal, anal, caudal, pectorals, and ventrals broadly blackish. Length $5^3/_4$ inches.

Type locality: Mé-Nam, Siam.

Habits: In the middle of Honshû, called "Kinki" District, the fish gather into the shallow water of a stream for spawning in the rainy season. The youngs migrate into the deep of a river and winter there. In general, they are found commonly in the middle of a river.

Distribution: Lake Biwa, Matsubara (JORDAN, THOMPSON); River Waka, near Wakanoura; Tsuruga; Lake Biwa, Matubara; Leke Yogo in Mino; River Yodo, Ôsaka; Nagoya, Owari (JORDAN, FOWLER); Lake Biwa (WAKIYA); Himezi (ABE); Okayama (MIKAMO); Mé-Nam, Siam (SAUVAGE); River Kino; River Arita, Wakayama Prefecture (UI); Lake Suwa (UENO); Lake Biwa (TANAKA); Zeze, Shiga Prefecture (O. H.S.)* River Fuji, Shizuoka Prefecture (AOYAGI); Gomura, Okayama Prefecture (TANAKA); River Yoshino, Shikoku (TANAKA & KASAI); River Yura on the Japan Sea coast (KISHIDA); River Kôzu, River Shimane; River Mabuchi, Aomori Prefecture (AOYAGI); River Yoneshiro, Akita Prefecture (AOYAGI & IDE); River Kuzuryu; Yamagata Prefecture; Niigata Prefecture; Fukui Prefecture (KATO); Nagasaki (TEMMINCK & SCHLEGEL); Around Ariake Bay; Yashiro sea coast; River Kotoku, Kagoshima Prefecture (OGAWA).

Genus **Liobagrus** HILGENDORF, 1878.

Liobagrus HILGENDORF, Sitzungs. Gesellsch. naturforsh. Freund., Berlin, 1878, p. 1.

Characters: Body elongate with compressed tail and rounded caudal. Head broad and depressed, top of head smooth, and the humeral process smooth; eyes small and covered with thin skin, anterior in position; snout broad, obtuse, and projecting; teeth only in jaws, in broad villiform bands, and those on the mandible divided; no teeth on palatines and vomer, barbels 8, the median mentals widely separated. Dorsal fin placed anteriorly; dorsal and pectoral spines smooth, sharp, and inbedded in the skin; adipose fin long and low, joined to the caudal as in *Noturus*; ventral fins small, not reaching the anal, which has 15 rays.

* Ôtsu Hydrobiological Station attachd to Kyôto University.

91. **Liobagrus reini** HILGENDORF.

Red Catfish, "Akaza"

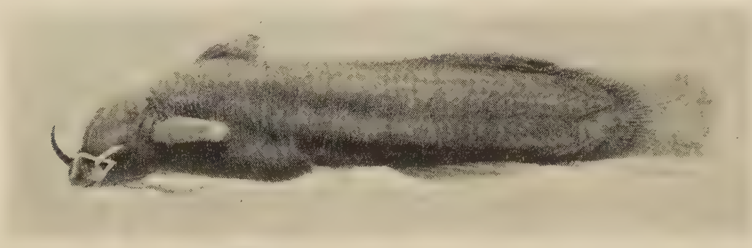
(Text-figs. 97, a–b)

Liobagrus reini, HILGENDORF, 1888, Sitzungs. Gesellsch. Naturforsch. Freund. Berlin, p. 1. – SAUVAGE, 1883, Bull. Soc. Philomat., p. 2. – JORDAN et SNYDER, 1901, Annot. Zool. Japan, III, p. 44. – JORDAN et FOWLER, 1903, Proc. U. S. N. Mus., vol. 26, no. 1338, pp. 909–911. ISHIKAWA, 1904, Proc. Dep. Nat. Hist. Tôkyô Imp. Mus., vol. 1, p. 2. – TANAKA, 1908, Annt. Zool. Japan, vol. 7, pt. 1, 10. – TANAKA, 1901, Annt. Zool. Japan, vol. 7, pt. 2, pp. 127. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. 6, p. 213. – TANAKA, 1921, Nihon Gyogaku, p. 172. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, p. 159. – UI, 1932, Kishyû Gyofu, pp. 28–29. – UENO, 1935, Kamikôchi oyobi Azusagawa Suikei no Suisei Dôbutsu, pp. 207–208, fig. 104. – MIYADI, 1935, Kyôtofu no Tansuigyo, pp. 16–17, pl. 3, fig. 10. – OKADA et NAKAMURA, 1948, Nihon no Tansuigyorui, pp. 147–148, fig. 67. – KAMOHARA, 1950, Descr. Fish. Prov. Tosa & Kishû, Jap., p. 42, fig. 37. – NIWA, 1954, Fish Kiso Valley, pt. 1, pp. 181–191, figs. 94–38.

Liobagrus sugubrii REGAN, 1908, Ann. Mag. Nas. Hist., (8) 1, p. 152. Gn. ? sp. ? ISHIKAWA, 1897, Prel. Cat., p. 23, Nos. 414, 415, 416.

The original description* is as follows:

Liobagrus reinii sp. n. Br. 15, D. $^{1}/_{6}$, A. 15, P. $^{1}/_{7}$, V. 6. – 1 Exemplar, 9cm. lang, von Prof. REINII südlichen Japan aufgefunden. Mit den bisher bekannten japonischen Bagrinen, *Pseudobagrus aurantiacus* SCHL. und *Liocassis longirostris* GÜNTH., nach Obigem sicher nicht identisch.



a



b

Text-figs. 97. ***Liobagrus reini*** HILGENDORF. ×1

Description: Head $4\,^{1}/_{2}$ in length; depth 8; D. I, 6; A. 15; P. I, 7; V. 6; width of head, $1\,^{1}/_{4}$ in its length; interorbital space 3 in head; eye 2 in interorbital space; cau-

* Sitzungsbericht der Gesellschaft naturforschender Freunde zu Berlin vom 16, Juli 1878, p. 1.

dal equal to head. Body elongate, of rather uniform depth, and tail strongly compressed. Head broad, depressed with a more or less swollen appearance above; snout short, much less than interorbital space, very broad and obtuse; eyes small, superiorly lateral, and covered with thin skin; mouth very broad, transverse, and about equal to half length of the head; lips moderate, upper jaw projecting; teeth in a single broad villiform band in the upper jaw, and in 2 narrowly divided similar patches on mandible; palatines and vomer toothless; 2 nasal barbels, 2 long maxillaries, and 2 still longer outer mentals which are about equal to length of head; inner mental barbels far apart and much shorter than maxillaries; interorbital space broad and more or less flattened. Gill openings large, rather inferior, and membrane with a deep notch; isthmus broad; branchiostegals large. Body naked and smooth; top of head smooth. Dorsal beginning before tip of pectoral spine, a little nearer tip of snout than base of ventrals, its spine smooth, without serrations, and more than half height of fin; adipose fin is long, low, ascending gradually till above and beyond tip of anal, and adnate to caudal by means of rudimentary rays of latter; origin of anal a little nearer tip of caudal than tip of snout, and well separated from caudal; caudal truncately rounded; pectoral spine smooth, sharply pointed, slightly curved, and more than half length of fin, which, is equal to width of head; ventrals small, beginning beyond tip o dorsal, a little longer than pectoral spine, and not reaching anal. Length $3\,^1/_8$ inches.

Color in fresh dark red on back and somewhat lighter on the belly.

Type locality: Southern Japan.

Table 97. Measurements of *Liobagrus reini* HILGENDORF.

Collection	Fish. Mie Univ.*				
Total length	95.0mm.	97.0mm.	81.0mm.	80.0mm.	89.0mm.
Body length	78.0	74.0	68.2	69.0	74.5
Body length/Head	4.58	4.53	4.40	4.69	4.33
Body length/Depth	6.34	5.68	5.24	5.52	5.10
Body length/Predorsal length	3.75	3.33	3.28	3.67	3.54
Body lerngth/Prepectoral length	5.20	4.93	4.70	5.18	4.81
Body length/Prevental length	2.14	2.20	2.22	2.25	2.24
Body length/Preanal length	1.59	1.61	1.64	1.69	1.66
Head/Snout	3.62	3.40	3.37	3.50	3.82
Head/Upper jaw					
Head/Interorbital width	2.50	2.55	2.59	2.53	2.73
Head/Diameter of Eye	14.20	10.90	11.30	11.30	11.50
Head/Length of Caudal peduncle	1.00	1.07	1.19	0.99	1.15
Head/Depth of Caudal peduncle	1.57	1.44	1.41	1.31	1.34
Head/Length of Dorsal fin	1.89	1.51	2.35	2.45	2.23
Head/Length of Anal fin	1.29	1.23	1.21	1.22	1.32
Head/Height of Dorsal fin	1.42	1.81	1.55	1.63	1.59
Head/Height of Anal fin	1.79	2.04	1.72	1.84	1.72
Head/Pectoral length	1.48	1.51	1.55	1.47	1.62
Head/Ventral length	2.33	2.55	2.58	2.30	2.53
Date	VIII, 1955				
Locality	River Machiya, Mie Prefecture				

*Faculty of Fisheries, Prefectural University of Mie, Mie Prefecture.

Distribution: Honshû (except Aomori Prefecture), Shikoku and Kyûshû; Lake Biwa, Matsubara (JORDAN & THOMPSON); Himezi (ABE); Toyama (YOSHIZAWA); Lake Biwa (JORDAN); Lake Kitagata, Fukui (JORDAN & HUBBS); Tsuyama (JORDAN & FOWLER); Niigata (IJIMA); Tuyama, Nagoya (OTAKI); Lake Biwa (REGAN); Tsuyama; Niigata; Nagoya (JORDAN & FOWLER); Ôshima, Hokkaidô; Iwashiro; Iga; Ise; Kii; Tsuyama; Mimasaku; River Yoshino, Yamato; Toshima in Hokkaidô; Iwashiro; Owari, Kii (ISHIKAWA); River Kiso, Gifu Prefecture (NIWA); River Kino, River Arita, Wakayama Prefecture (UI); Kyôto (MIYADI); Shikoku (KAMOHARA); Lake Biwa (TANAKA); Shinano Prov., Nagano Prefecture (TANAKA); River Miya, Takayama, Hida, Gifu Prefecture (UENO); Ina, River Tenryû, Nagano Prefecture (MAKIUCHI); Tsuyama, Okayama Prefecture; Lake Aoki, Nagano Prefecture (KAWAMURA); River Yura, Ayabe, Kyôto (MIYADI); River Abukuma, Miyagi Prefecture (AOYAGI); the northern Akita Prefecture (AOYAGI); River Kotsu, Shimane Prefecture (AOYAGI); River Chikugo; River Yabe, Kumamoto Prefecture (AOYAGI); River Kiso (TANAKA); Lake Biwa; River Yodo; (JORDAN & HUBBS); River Iho, Hyogo Prefecture (TANAKA); River Yoshii, Okayama Prefecture (ISHIKAWA); Kôchi Prefecture; River Yoshino, Tokushima Prefecture (TANAKA & KASAI).

Remarks: TANAKA[2] showed the individual variations of the species from the specimens of Shinano Province, Nagano Prefecture. The slenderness of body, the width of interorbital and the length of fin spines varied in specimens from same locality. He remarked further that *Liobagrus reini* described by JORDAN and FOWLER in 1903 seems to differ so very slightly from *Liobagrus sugubii* REGAN. He hesitated to draw specific distinction between the two, although most of the specimens stand nearer to *sugubii*.

NIWA[3] mentioned the spines of the fish; the one is the lst spine of dorsal fin and the second is the lst spine of pectoral fin. They are distinguished characters from those of *Parasilurus asotus* and poisonous for protecting of enemies.

Habits: The breeding season continues from the end of May to the beginning of June. The spawning ground is selected on the pebbly basin of the shallow, clear current waters. The female deposits eggs in the sepace under stones. The eggs are connected one another by the gelatious substance to form an irregular mass containing 100–120 eggs. After spawning, the female stays around the ground to protect the eggs. UCHIDA[1] described a short note of the life history of the very closely allied species *Liobagrus andersonii* found in Korea. Eggs are deposited under the stones of streams making a egg mass measured about 3–4 cm. in large and composed of 100–120 eggs. Eggs are cubical, large, 3.3 mm. in diameter; yolk heavy, transparent, yellow, with minute granules inside, without oil globules eggs with gelatinous membrane, measured 4.6 mm. in diameter including the egg. They hatch out in 8–9 days after fertilization, under the water temperature of 17°–22°C.

1) UCHIDA, 1933, Zool. Mag., 45, pp. 390–292.
2) TANAKA, 1909, Annt. Zool. Jap., vo . 7, pt. 2, p. 127.
3) NIWA, 1954, Fish. Kisodani, p. 185.

Just hatching out larva measured 1.8 mm. in total length, with 38 myotomes. Head rounded, with very small eye; lower jaw short; one pair of mandibular barbel (so called second mandibular barbel) short; two pairs of maxillary barbel and the first mandibular barbel not yet developed. This fish is commonly found in the upper region of a clear current river and seems not to descend into the lower region of the river.

Order Apodes

Characters: Body elongate, cylindrical, or compressed. Gill openings comparatively small. No pseudobranchiae. Premaxillaries not developed as distinct elements. Maxillaries border smooth. Opercles small, membrane covering large branchial chamber chiefly supported by long branchiostegals. Single pair of dentigerous upper pharyngeals opposed to separate lower pharyngeals. Gonaducts reduced to genital pores. Air vessel joined to oesophagus by tube. Scales rudimentary or absent. Lateral line present or absent. Dorsal and anal fins continuous to or with reduced caudal, when present. Pectorals small or absent. Ventrals absent.

Suborder Anguillina

Family Anguillidae

Characters: The tue eels or Anguillidae ara characterized by their scaly skin in association with a conical head and a general resemblance to the Congers.

The Enchelycephalous Apodals with conical head, well-developed opercular apparatus, lateral maxillines, cardiform teeth, distinct tongue, vertical lateral branchial apertures, continuous vertical fins, with the dorsal far from the head, pectorals well developed, scaly skin, and nearly prefect branchial skeletons.

Genus Anguilla Shaw, 1804.

Anguilla, Shaw, General Zoology, iv, 15, 1804.

Muraena, Bleeker, Poey, etc. (taking as type *Muraena anguilla*, the 1st species mentioned by Artedi under *Muraena*).

Characters: Body elongate, compressed behind, covered with embedded scales which are linear in form and placed obliquely, some of them at right angles to others. Lateral line well developed. Head long, conical, moderately pointed, the rather small eye well forward and over the angle of the mouth. Teeth small, subequal, in bands on each jaw and a long patch on the vomer. Tongue free at tip. Lips rather full, with a free margin behind, attached by a frenum in front. Lower jaw projecting. Gill openings rather small, slitlike, about as wide as base of pectorals and partly below them. Nostrils superior, well separated, the anterior with a slight tube. Vent close in front of anal. Dorsal inserted at some distance from the head, confluent with the anal around the tail. Pectorals well developed. Species found in most warm seas, (the eastern Pacific excepted), ascending streams, but mostly spawning in the sea.

Key to the Japanese species of Anguilla

a[1]. Vertebrae fewer in numbers, 99–105 .... **A. marmorata**
a[2]. Vertebrae 113–117 in number .... **A. japonica**

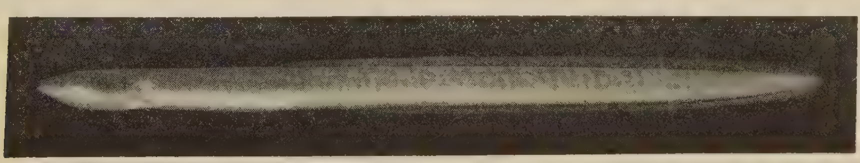
92. Anguilla japonica TEMMINCK et SCHLEGEL.
Eel, "Unagi"
(Text-fig. 98)

Anguilla japonica TEMMINCK et SCHLEGEL, 1847, Fauna Japonica, Poiss., p. 258, pl. CXIII, fig. 2. – BLEEKER, Verh. Bot. Gen. xxv, p. 51. – KNER, 1865, Novara Fische, p. 370. – JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., p. 348. – JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., XXIII, p. 842. – ÔTAKI, 1906, Nihon Gyorui Zusetsu, pp. 45–46. – MATSUBARA, 1908, Nihon Gyokairui Zusetsu, pp. 77–78. –TANAKA, 1909, Annt. Zool. Japon., vol. 7, pt. 2, p. 135. –JORDAN et METZ, 1913, Mem. Carn. Mus., vol. 6, no. 1, p. 24. – TANAKA, 1913, Figur. Descr. Fish. Japan, pp. 148–150, pl. XL, figs. 152, 153, 154. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. 6, no. 4, p. 233. – TANAKA, 1921, Nihon Gyogaku, pp. 202–203. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. 10, no. 2, pp. 190–191. – EBINA, 1931, Nihon Chôyô Gyorui Zushû, pl. 40. – UI, 1932, Kishû Gyofu, pp. 38–40. – UENO, 1935, Kamikochi oyobi Azusagawa Suikei no Suisei Dôbutsu, pp. 227–228. – MIYADI, 1935, Kyôtofuka no Tansuigyo, pp. 35–36. – OKADA, MATSUBARA, 1935, Nihon Gyorui Zusetsu, p. 90, pl. 34, fig. 4. – CHEVEY et LEMASSON, 1937, Cont. Poiss. Eaux douces Tonkinoises, pp. 114–115, pl. xxxv, fig. 78. – OKADA et IKEDA, 1938, Saitô Hô-on Kai Mus. R. Bull. no. 15, p. 90. – NAKAI et MATSUI, 1938, Zool. Mag., vol. 50, no. 4, p. 184. – NICHOLS, 1943, Freshwater Fish. China, p. 32. – OKADA et NAKAMURA, 1948, Nihon no Tansuigyorui, pp. 187–188, fig. 116. – KAMOHARA, 1950, Descr. Fish. Prov. Tosa & Kishû, Japan, p. 49. – MATSUI, 1952, Stud. Jap. Eel, Norinsyo Suisan Koshyûzyo Kenkyû Hôkoku, 2, 2, pp. 1245. – NIWA, 1954, Fish Kiso Vall., pp. 82–96, pl. VIII, figs. a–b. – AOYAGI, 1957, Gen. Notes. Fresh. Wat. Fish. Jap. Arch., pp. 174–177, fig. 148.

Anguilla bostoniensis GÜNTHER, 1870, Cat. Fish. Brit. Mus., VIII, p. 31.

Anguilla remifera JORDAN et EVERMANN, 1903, Proc. U. S. Nat. Mus., xxv, p. 325.

Anguilla manabei JORDAN, 1913, Proc. U. S. Nat. Mus., vol. 44, no. 1957, pp. 359–360.



Text-fig. 98. ***Anguilla japonica*** TEMMINCK et SCHLEGEL.

The original description* is as follows:

Anguilla japonica, pl. CXIII, fig. 2(1). L'anguille commune du Japon y remplace l'anguille commune d'Europe avec ses races, l'anguille bicolore de Lesueur, originaire des grands fleuves de l'Amérique du Nord, et le Choroloo-Pamoo ou Malgumara de Russell, Pl. 31, espèce qui habite les eaux douces de l'Indoustau et de l'ile de Java. Toutes ces espèces sont absolument modelées sur le même type, et ne se distinguent entre elles, que par des différences plus ou moins sensibles dans les teintes.

* TEMMINCK & SCHLEGEL, 1847, Fauna Japonica Poissons. p. 258, pl. CXIII, fig. 2.

et dans les proportions des diverses parties du corps. L'espèce du Japon, comparee à celle d'Europe, s'en éloigne principalement par des formes un peu plus grêles, par des yeux moins volumineux, par un peu plus allongé, par des pectorales tant soit peu plus grandes et par quelques différences dans les teintes.

La hauteur du tronc est environ vingt fois dans la longueur totale de ce poisson; le diamètre transversal du tronc n'est que d'un cinquième moindre que sa hauteur. La longueur de la tête, c'est-à-dire de la distance comprise entre l'extrémité du museau etle bord de l'ouverture des ouies, occupe le huitieme de la longueur totale du poisson. Le museau entre cinq fois dans la tête; l'aeil est deux fois et demie dans le museau, et l'entre-deux des yeux est du double plus considérable que le diamètre de l'aeil. La longueur des pectorales fait un peu plus du tiers de la longueur de la tête; et la dorsale commence près de la fin du deuxième tiers de la distance comprise entre l'orifice des ouirs et l'anus. Ce dernier orifice s'ouvre vers la fin du deuxième cinquième de la longueur totale du poisson. La mâchoire inférieure dépasse, comme d'ordinaire, un peu la supérieure, et le bord postérieur des mâchoires s'étend jusqu'un peu au delà de l'aplomb du bord posterieur de l'aeil. Les dents ne diffèrent pas de celles de l'espèce commune; il en est de même de la forme des nageoires, de la ligne latérale, et de la structure de la peau. Nos plus grands individus portent un pied et demi en longueur totale.

Cette espèce est, a l'état frais, d'un brun verdâtre ou olivâtre passant au blanchâtre sur la moitié inferieure du poisson. La partie supérieure de la grande nageoire est d'un brun clair, la partie inférieure est blanchâtre mais cette nageoire tire, sur le tiers postérieur de la queue, fortement au brun cuivreux foncé.

Description: Body greatly elongate, slender, subcylindrical in front, becoming more and more compressed backward; its greatest width 1.11–1.23 in its depth. Length of head and trunk 1.27–1.6 in tail. Head short, depressed anteriorly, subcylindrical at nape; its depth at gill-opening equal to or slightly greater than its width at the same region and contains 2.27–3.7 in its length. Snout rather short, its tip broadly rounded in a dorsal view. Eye very small, subcutaneous, superolateral; combined length of snout and eye 2.84–3.23 in postorbital part of head. Interorbital space moderate, flat. Nostrils two on each side: anterior one in a short tube at anterior margin of upper lip, its length about half diameter of eye; posterior one slit-like, immediately in front of eye and on a level with upper border of the latter. Mouth rather narrow, slightly obliqui, superolateral; its width 3.7–4.1 in head; corner of mouth nearly reaching vertical through posterior margin of eye; lower jaw slightly longer than upper; lips well-developed, provided with long labial grooves. Tongue well-developed, its tip and sides free. Gill-opening not small, crescent shaped, width between its angles 8–10 in head, its upper angle immediately below anterior third of base of pectoral. Scales small, elongate, imbedded in skin, arranged in small groups, which are placed at right angles to one another. Lateral line present, with 32–35 pores between gill-opening and vent.

Dorsal and anal well-developed, very long, confluent with very small caudal fin; origin of dorsal in front of vent, distance between verticals through these two points 3.96–6.21 in combined length of head and trunk; origin of anal slightly behind vent. Pectoral small, round, its origin above and slightly in front of upper angle of gill-opening.

Color in fresh variable, mostly dark brown or yellowish brown above, rarely marbled; abruptly paler below; pectoral pale; dorsal, anal, and caudal edged behind with

black; in female the color generally lighter.

Secondary sexual characters: In male, the snout is short and pointed, while in female, long and broad. The diameter of the eyes of male is larger than that of female. The pectoral fin of male is longer than that of female, and somewhat pointed while that of female blunt at the end. The dorsal fin of male is shorter and lower. The orientation of the dorsal and anal fins of male is situated somewhat anterior than that of female. The color of male is mostly dark green and black on the back and shows metalic luster on the lateral, and white on the belly. In the female, the back is green and somewhat yellow on the belly.

Type locality: Nagasaki.

Habits: In the Pacific region including the Japan Sea, the breeding habits of the present species are not yet researched. A few facts concerning the ripeness of gonad are mentioned only by I. Matsui and others. During the middle of August and the beginning of October, the so-called "Kudari Unagi", descending eel, measured 350–370 mm. in body length, descending in night and rainy season, has an unripened gonad. It stays in the sea coast or island bays during somewhat a long time and migrates into the open sea. According to I. Matsui's investigation, the descending eel has 5987681–10102983 eggs in one individual measured 924.2 mm. in body length. In regard to the spawning grounds of eel around Japan, Sh. Tanaka (1930) suggested that the common eels are distributed abundantly in the Pacific coast than in the Japan Sea and they do not spawn in the Japan Sea. K Uchida (1935) reported of the *Leptocephalus* of eel from a spot off 120 miles, south of Osumi Peninsula, Kagoshima Prefecture and H. Marukawa (1913), from a spot off Hiwasa Machi, Tokushima Prefecture. In Japan, the ascending young of eel is called "Shirasu Unagi", meaning 'a white young eel', comes to the mouth of the river in autumn, and when the water temperature raising up above 10°C. in February and March of the next spring, they being to ascend the river. The ascending occurs night and day. When they come into the river, they sink at the bottom in the daytime and active to ascend along the river coast after the sunset. The black, untransparent eel, called "Dakko Unagi". This may be a slow growth form which ascended in the last year. The eel likes to live in the warmer water and is found everywhere in river, pond, swamp and paddy field. The natural food of the adult is consisting of small fishes, crustaceans, aquatic insects and worms. They take all kinds of animal food at night and when the water temperature comes down below 14°C., they lose-appetite.

Distribution: The present species are distributed widely from north to south and western coasts of Hokkaidô. The orthern limit on the Pacific coast is the Hidaka district, Hokkaidô (Nozawa) and on the Japan Sea coast is the River Ishikari (Nozawa) and southern Karafuto (Okada, Sh.). In the north of the Noto Peninsula of the Japan Sea, the eels are found less in number and very few in Yamagata, Akita and Aomori Prefectures and quite rare in south and western Hokkaidô. Nagasaki (Temminck et Schlegel); Hakodate; Aomori; Same; Matsushima; Sendai; Tokyô; Misaki; Sagami; Wa-

kanoura; Ômura Bay; Kurume; Nagasaki (JORDAN et SNYDER); Hakodate to Kagoshima (TANAKA); Misaki; Okayama (JORDAN et THOMPSON) Tsushima (JORDAN et METZ); Nagano Prefecture (TANAKA); Nagano Prefecture (UENO); Mikawa Bay (ISHIKAWA); Himeji (ABE); Lake Suwa (OTA); Lakes Suwa; Hakone (JORDAN); Fukuoka (HAMADA); Lake Tôgô (INOMATA); Lakes Mikata; Kasumigaura (HATTORI); Yokohama (OTAKI); Akita Prefecture; Iwate Prefecture., Miyagi Prefecture.; (OKADA, IKEDA).

Remarks: ÔTAKI* mentioned general aspects of Japanese eel as follows: "The eel dish is called Unagi-no-kabayaki and it is a favorite one in Tokyô. It has been called so as it was formerly broiled in the form of the spike of the rash. Now it is however dorsally split open and boned and steamed stuck on small sticks of bamboo, and then broiled over a brisk charcoal fire; as it is often dipped in a well prepared sauce of soi. It is rich in taste and soft when it is thus prepared."

Much has been said and discussed of the breeding habit of the fish and there are several points left to be studied in its life history. Unequally, however, to an anadromous habit of Salmonidae its earlier life is spent in freshwaters of muddy bottom feeding in the night on animal organisms. The period of sojourn in fresh water of their early life is about four years when they descend rivers to the sea to spawn, the male precending the female. No obstacles before them when it is the period of their descent. They make their way to the sea; even a dam is no barrier to them.

It is said that a single female produces many eggs as 5,000,000 ova, which are colorless and transparent with no oil-globule. Uncertain as the spawning ground multitudes of transparent ribbon-shaped young of this eel of about $5\,^1/_2$ inches long are found in the sea in about February and March. In a year these band-shaped young grow into little eels of about 3 inches long and ascend rivers in the night in congregations along the land".

93. **Anguilla marmorata** QUOY et GAIM URAN.

"Ounagi, Kanikui"

Anguilla marmorata QUOY et GAIM URAN, 1824, pl. 51. fig. 2. – KAUP, Catal. Apod. fig. 32. – KNER, 1865, Novara Fische, p. 369.

Anguilla mauritiana BENETT, 1831, Proc. Zool. Soc. London, p. 128. – GÜNTHER, 1870, Cat. Brit. Mus., vol. VIII, p. 25. – GÜNTHER, 1910, Fische d. Südsee, vol. III, p. 390. – JORDAN et EVERMANN, 1902, Proc. U. S. Nat. Mus., vol. xxx, no. 1289, p. 32. – STEINDACHNER, 1906, Sitzber. Akad. Wien, p. 1420. – Max WEBER, 1912, Zoolog. Jahrb. Suppl. xv, Bd. 1, p. 582. – WEBER et BEAUFORT, 1916, Fish. Indo-Australian Archip. III, pp. 245–246, figs. 100, 102. – UI, 1932, Kishû Gyofu, pp. 40–41, fig. 10. – MIYADI, 1935, Kyôtofuka no Tansuigyo, pp. 35–36. – NICHOLS, 1943, Freshwater Fishes

* OTAKI, 1906, pp. 45–46.

China, pp. 32-33. – KAMOHARA, 1950, Descr. Fish. Prov. Tosa & Kishû, Japan, p. 49. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 177–188, figs. 149–150.

Anguilla labrosa, RICHARDSON, 1844, Zool. Voy. Erebus & Terror, vol. III, p. 113.

Anguilla labiata PETERS, 1852, Monatsber. Akad. Berlin, p. 17. – GÜNTHER, 1866, Fishes of Zanzibar, p. 124. – PETERS, 1868, Reise, nach Mossambique, Flussfische, p. 94. – PFEFFER, 1893, Ostafrikanische Fische, gesamm. von Stuhlmann, Jahrb. Hamburg, Anst. vol. x, p. 41. – PFEFFER, 1896, Die Fische Ost. Afrikas, p. 71.

Anguilla johannae GÜNTHER, 1866, Fishes of Zanzibar, p. 124.

Muraena marmorata KNER, 1865–1867, Novara Reise, Fische, p. 369.

Anguilla fidjiensis GÜNTHER, 1870, Cat. Brit. Mus., vol. VIII, p. 26. – GUNTHER, 1910, Fisched. Südsee, vol. III, p. 390.

Anguilla bengalensis, BOULENGER, 1915, Cat Freshwater Fishes Africa, III, p. 7. – CHU, 1931, Biol. Bull.St. John's Univ. Shanghai, no. 1, p. 22.

Description: Body height 14–21, head 7–7 $^3/_4$; eye 9–15, 2–3 times in the interorbital space, 2–3 times in snout, the length of which about 4 $^1/_2$ times. Head short, about equal to distance from gill-opening to dorsal fin. Mouth opening thrice in head, reaches hind border of eye or semewhat farther; lips very thick; anterior nasal tubes prominent. Distance from anal to front of dorsal much greater than head. Pectorals 16–18 rays, 2.7 in head. Snout broader at its base than its length. Tail longer than head and trunk. Intermaxillary and vomerine teeth forming a rhombic band with slightly concave side-borders; posteriorly rapidly tapring into a point, which does not reach so far as the maxillary teeth. The maxillary teeth arranged in two outer series, the inner one of which carries the longest teeth, which border an edentuloses longitudinal groove. Inward of this groove there are about 3 series of teeth opposite to the vomerine band but separated from it by a groove. These 3 series are posteriorly gradually reduced to one sereis. Mandibulary teeth outside the edentulous groove anteriorly in 2–3 series, of which the inner one has the largest teeth, which are continued posteriorly. Inside of the groove there are anteriorly several specimens ventral serface light, dorsal surface dark, especially the last with different large spots. Length more than 1600mm. Vertebrae 99–107. Body much mottled with black.

The breeding habit is unknown. They are mostly found in the body of current rivers of large water quantity. The food is consisting of large freshwater fishes and crustaceans.

Distribution: They are widely distributed from Africa, Ears Indies, Philippines and South China. Formosa (OSHIMA), Botel Tobago (JORDAN & EVERMANN, KANO); Loo Choo Islands (OKADA, AOYAGI); Amamioshima; Yakushima; Tanegashima (OGAWA): Kagoshima; Miyazaki; Nagasaki; Ôita; Tokushima; Wakayama; Shizuoka and Chiba Prefectures (KABURAKI, OGAWA): Bonin Islands (ISHIKAWA); River Tomita; River Koza, Wakayama Prefecture (UI); Wakayama Pref.; Kyûshû; Ôsaka (MIYADI); Tosa, Kôchi Prefecture., Shikoku; Kyushû, Wakayama Prefecture (KAMOHARA); River Tomita, Nishimuro-gun, Wakayama Prefecture. (UI); Ionoike, Izu, Shizuoka Prefecture. (NIWA); Kagoshima, Nagasaki Prefecture; River Haha, Kawanishi-mura, Tokushima Prefecture; River Tomita, Nishimuro-gun, Wakayama Prefecture (AOYAGI); Formosa

(OSHIMA); Botel Tobago Isl. (KANO); Ryûkyû (OKADA, AOYAGI); Amamioshima; Yakushima; Tanegashima (OGAWA); Kagoshima Prefecture; Miyasaki Prefecture; Nagasaki Prefecture; Ôita Prefecture; Tokushima Prefecture; Wakayama Prefecture; Shizuoka Prefecture; Chiba Prefecture (KABURAKI); Ogasawara Isl. (Ishikawa); Quelpart Isl. Korea (MORI, OCHIDA).

Remarks: In Wakayama Nagasaki and Tokushima Prefectures, this species is protecting as one of the natural monument from March, 1923.

Order Cyprinodontida

Characters: Mouth terminal. Maxillaries not entering gape, not forming upper jaw edge, which is bordered by extremely protractile premaxillaries. Second, third, and fourth upper pharyngeals with teeth, lower separate or with persistent median suture. Branchiostegals 6 or less. Air vessel without duct connecting esophagus. This order, which reaches a very large development in the Western Hemisphere, is comparatively sparsely represented in the Old World.

Suborder Cyprinodontina

Characters: Mouth small, unless jaws are produced. Premaxillaries usually protractile. Maxillary little movable, joined to preorbital. Teeth in jaws and sometimes on vomer, never on palatines. Gill membranes free from isthmus. Ventrals usually well-developed, with 6 rays, sometimes absent.

Family Cyprinodontidae

Characters: Body oblong or moderately elongate, compressed behind, depressed farward, covered with rather cycloid scales, which are adherent and regularly arranged. Lateral line represented by a few imperfect pores. Head scaly, at least above. Mouth terminal, small, the lower jaw usually projecting. Teeth incisor-like or villiform, sometimes present on the vomer, but usually in the jaws only; lower pharyngeal enlarged, the fourth wanting or united to the third. Gill membranes somewhat connected, free from isthmus; gill rakers very short, thick. Branchiostegals 4 to 6. Pseudobranchiae none. Dorsal fin single, inserted posteriorly of soft ray only, rarely with a single spine or a rudimentary spinous dorsal; caudal fin not forked; ventral fins abdominal, rarely wanting; pectoral fins inserted low; no adipose fin.

Genus **Oryzias** JORDAN et SNYDER, 1906.

Type = **Oryzias latipes**

Characters: Body elliptical in form, compressed, covered with large scales; mouth small, with 2 rows of small, simple, pointed teeth; no teeth on vomer; gill opening not restricted above; intestinal canal short, about as long as body; peritoneum black. Dor-

sal fin short, inserted above middle of anal; anal very long, of 17 to 20 rays; caudal fin truncate. Sexes similar, except in color; anal fin not modified in the male.

94. Oryzias latipes (Temminck et Schlegel)

"Medaka"

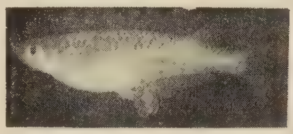
(PL. L, figs. 1–18, Text-figs. 99, a–b)

Poecilia latipes Temminck et Schlegel, 1846, Fauna Japonica, Poiss., p. 224, pl. cii, fig. 5.

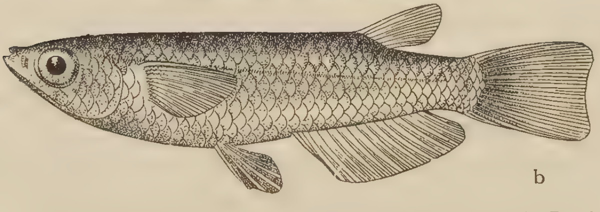
Aplocheilus latipes Bleeker, 1860, Art. Soc. Sci. Ind. Neerl. vii, p. 99. – Jordan et Snyder, 1901, Check list, p. 57. – Jordan et Snyder, 1901, Proc. U. S. Nat. Mus., 23, p. 530. – Aoyagi, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 66-68, figs. 51-53.

Haplocheilus latipes Günther, 1886, Cat. Fish., vi, p. 311. – Ishikawa et Matsubara, 1897, Prel. Cat., p. 18.

Oryzias latipes Jordan et Snyder, 1906, Proc. U. S Nat. Mus., vol. 31. no. 1486, pp. 289–290, fig. 1. – Tanaka, 1921, Nihon Gyogaku, pp. 322–323, fig. 97. – Ui, 1932, Kisyu Gyofu, pp. 71–72.



a



b

Text-figs. 99. a. ***Oryzias latipes*** (T. et Sch.). ♀ × 1
b. ***Oryzias latipes*** (T. et Sch.). ♂ × 3

The original description is as follows:

1. *Poecilia latipes**, Pl. CIII. fig. 5. Les eaux douces du Japon produissent une espèce de *Poecilia* qui parait se distingueur de toutes celles connues jusqu'à ce jour par son anale très-longue, par sa dôrsale assez reculée en arrière, et parce que sa membrane branchiostège est pourvue de trois rayons seulement au lieu de cinq, caractères en faveur desquels on pourrait élever cette espèce au rang des sous-genres.

Ce petit poisson atteint une longueur totale d'un pouce et demi à deux pouces. La longueur de la tête egale la hauteur du corps et entre environ cinq fois dans la longueur totale du poisson. La tête est de forme conique, comme d'ordinaire dèprimèe par devant, et sa ligne supérieure est presque horizontale. Les dents ne different pas de celles des autres espèces, c'est a dire qu'ily en a une rangèe de, resfines dans chaque mâchoire. La bouche forme une fente transversale qui s'ouvre â l'extrémité du museau; la mâchoire inferieure est disigée vers le haut, lorsque la bouche se trouve fermée. Les yeux sont assez grands, latéraux et rapproches du sommet de la tête; ils occupent le tiers moyen de la longueur de la tête. Les opercules sont arrondis et lisses. Les écailles sont assez grandes, et leur

*Temminck et Schlegel, 1846 Fauna Japonica Poisson, p. 224.

surface se trouve couverte de stries concentriques très-fines; on en compte environ trentecinq rangées entre l'opercule et la base de la queue, et dix rangées entre le dos et ventre. Il ne parait pas exister de ligne latérale. L,anus s'ouvre immédiatement au devant de l'anale, ur le mi'esu de la longueur du corps.

Les pectorales naissent au-dessus de l'angle de l'opercule; leur longueur égale presque celle de la tête; elles sont pointues et de forme lancéolée. La dorsale très-petite, étant assez reculée en arrière, lele correspond au dernier tiers de l'anale. Cette nage oire, au contraire, est très-large et de moitié plus basse par derriére que par devant, où sa hauteur fait un peu plus de la moitié du corps aux pectorales. Les ventrales sont pointues, et placés au milieu de la distance comprise entre l'opercule et l'anus qu'elles atteignent lorsqu'elles sont conchées en arrière. La caudale n'est pas tres-développée, et est tant soit peu chancrée à l'extrémité. B. 3; D. 6; A. 20; V. 7; P. 14; C. 14.

A l'état frais, ce poisson est d'un brun très-pâle, tirant au bleu sur les flancs, et passant au jaunâtre sur le ventre et vers la base de l'anale. L'anale, la caudale et la dorsale sont quelquefois variées de noirâtre.

On désigne ce poisson au Japon sous le nom de *Medaka*. Il y est très-commun dans les eaux stagnantes, telles que les champs de riz inondés, notamment en été.

Description: Head $3^1/_2$ in length to base of caudal; depth $3^1/_2$; depth of caudal peduncle $7^1/_2$; eye $2^1/_2$ in head; snout 4; inierorbital space $2^1/_3$ D. 6; A. 17; scales in lateral series 31.

Eye very large; interorbital space flat; snout short; lower jaw slightly projecting. Gill openings not restricted above by membrane, opening extending to upper edge of pectoral. Branchiostegals 5. Gill rakers on first arch 13, short and rather blunt. Jaws with 2 rows of simple, pointed teeth, those in posterior row minute and difficult to detect; vomer smooth; pharyngeals with minute teeth, mostly arranged in 12 or 13 transverse rows above, 6 or 7 below. Intestinal canal about equal to length of body. Peritoneum dense black within, outer surface next to length of body. Peritoneum dense black within, outer surface next to the body wall bright silvery. Top and sides of head, throat, and chin naked; lateral line absent. Dorsal fin short, its origin above middle of anal; its height equal to or greater than distance between tip of snout and posterior border of eye, the depressed fin usually falling short of base of anal, in some cases reaching it. Anal base very long, the posterior rays highest, about equal in height to those of dorsal, extending to base of caudal when depressed. Pectorals inserted parthy below median line of body, their length contained about $4^1/_3$ times in body. Ventrals pointed, short, just reaching vent when depressed. Caudal truncate, $4^1/_2$ in the length.

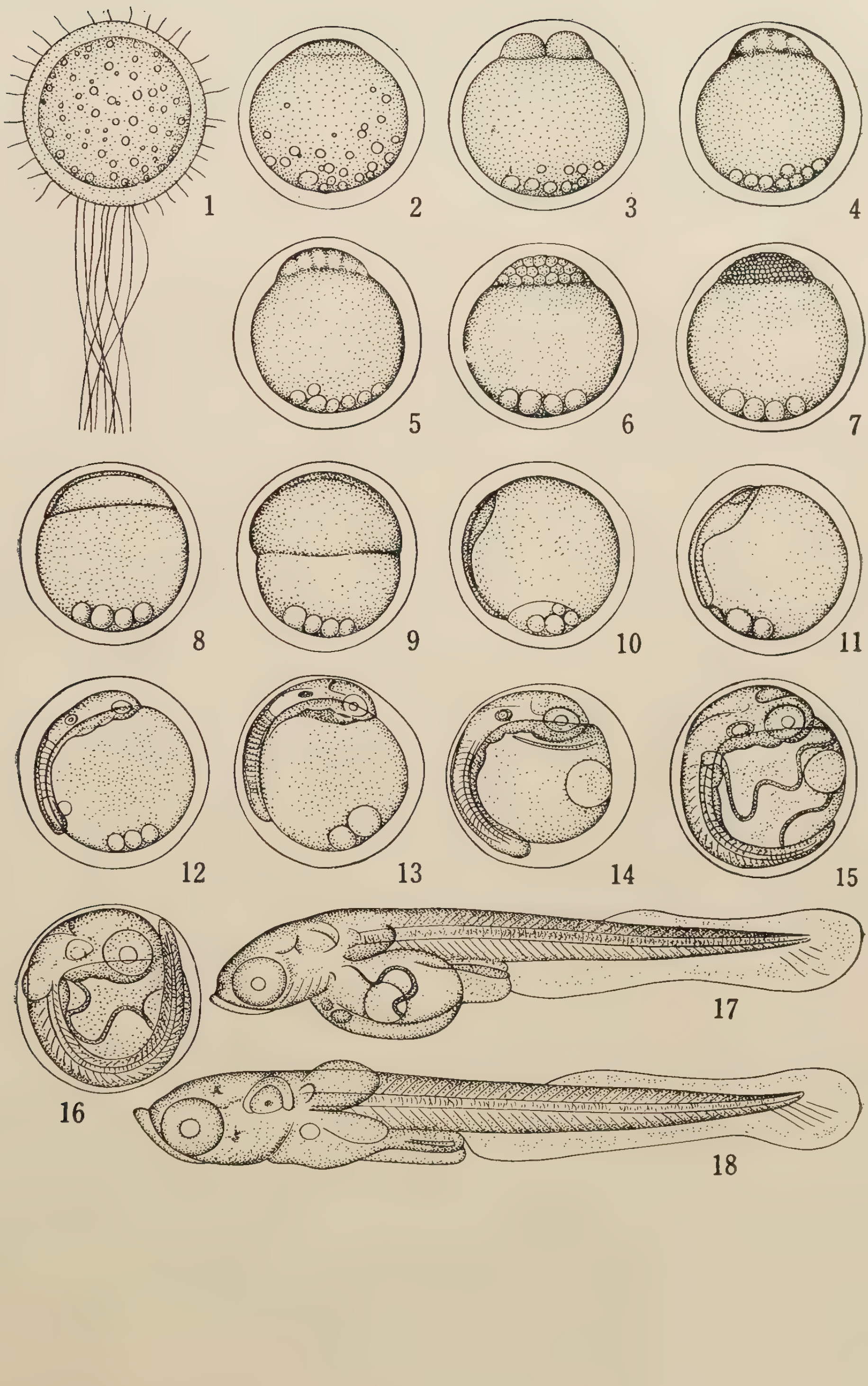
Color in alcohol, light brownish, the silvery coating of peritoneum showing through walls of abdomen; a narrow, median, dusky stripe extending along back from occiput to dorsal; sides of body sparsely stippled with black, the edges of scales dusky; a median, dusky line extending along sides of body from tip of pectoral to base of caudal; membranes of fins dusky, the color deepering toward the edges; ventrals black; a narrow light area on base of caudal.

The female has a more slender body, especially in the region posterior to anal opening; the anal is lower and the vientrals are usually longer, often reaching beyond base of anal. The ventrals are immaculate or only slightly dusky. No modification of the anal rays appears to distinguish either sex.

PLATE I.

Development of ***Oryzias lactipes*** TEMMINCK et SCHLEGEL. after K. MATSUI (1949),

1. Fertilized egg measuring 1.3 mm. diameter with long filaments.
2. Egg, 1° afetr fertilization.
3. Two cell stage, 2°30′ after fertilization.
4. 8 cell stage, 3。30′ after fertilization.
5. 19 cell stage, 4°20′ after fertilization.
6. Morula stage, 6°5' after fertilization.
7. Blastula stage, 8°5' after fertilization.
8. More advanced blastula stage, 17° aftre fertilization.
9. Blastoderm covers one half of the egg, 23° after fertilization.
10. Early embryo with head, 1 day 10° after fertilization.
12. Embryo with 9 myotomes and lens on optic vesicle, 2° after fertilization.
13. Embryo with 15 myotomes and beating,, heart 2 days 14° after fertilization.
14. Embryo with 22-23 myotomes, and few melanophores on optic vesicle, 3 days 6° after fertilization.
15. Embryo with long tail pointed at end, 4 days after fertilization.
16. Embryo advanced, the end of tail approaching to eye with large pectoral fin, 6 days after fertilization.
17. Just hatching larva, 11 days after fertilization under the water temperature 23°c in constant.
18. Larva 3 days after hatching.


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Distribution: This is very common in ditch in a rice field Honshû, Kyushû and Shikoku and not in Hokkaidô. Wakanoura; Kawatana; Nagasaki (JORDAN & SNYDER); Nagasaki (SCHLEGEL); Yokohama (JORDAN & SNYDER); Nagasaki (BLEEKER); Nagasaki (GUNTHER); Tôkyô (ISHIKAWA); Ôma, Aomori Prefecture; Amamioshima (AOYAGI).

Remarks: *Fundulichthys virescens* (TEMMINCK et SCHLEGEL) called "Omedaka" in Japanese was unidentified by the imcomplete specimen of *Pseudorasbora parva*.

Order Belonida

Characters: Body very slender and their anal, dorsal, and ventral fins set for back. Jaws prolonged to form a long slim beak well armed with teeth. Branchiostegals 9 to 15. Vertebrae 45 to 70, abdominal much more numerous than caudal. Air vessel large, without pneumatic duct. Intestestinal canal simple, without pyloric caeca. Lateral line concurrent with belly. No. finlets between the dorsal and anal fins and caudal. Ventral abdominal, rays more than 5.

Suborder Exocoetina

Characters: Lower pharyngeal bones fully united; second and third superior pharyngeals variously enlarged, not articulated to the cranium, seconding processes forward; the forth small or fused with the third. Vertebrae numerous (45 to 70), the abdominal, without spine, the rays more than five. Scapula suspended to the cranium by a post-temporal bone, which is usually simple, furcate in Belonidae. Articular bone of lower jaw with a small supplemental bone perhaps corresponding to the coronoid bone. Parietar bones usually absent, when present much reduced, well separated by the supraoccipital. Supraclavicle small when present; no interclavicles. No mesocoracoid. Maxillary very close to premaxillary and sometimes firmly joined to it, the suture always distinct. Basis of cranium double in front, but without muscular tube. No adipose fin. Fins without spines. Lateral line concurrent with the belly, peculiar in structure. Air bladder usually large, without pneumatic duct. Intestinal tract simple, without pyloric caeca.

Family Hemiramphidae

Characters: Body elongate, more or less compressed, covered with large cycloid scales; upper jaw short, lower jaw various, sometimes much produced, the toothed portion at fitting against the toothed premaxillaries; teeth equal, mostly small and tricuspid; maxillaries anchylosed to premaxillaries. Gill rakers long. Caudal fin rounded, or forked, if forked; the lower lobe longer. Anal fin modified in the viviparous species, unmodified in the others and usually simslar to the dorsal; no finlets; air bladder large, sometimes cellular. Third upper pharyngeal on each side much enlarged, solidly united with its fellow to form an oval plate, with slightly convex sufface and covered with blunt tricuspid teeth; this is about as large as the united lower pharyngeals, and fits into the concavity of the latter; fourth upper pharyngeal wanting or grown fast to the

third; lower pharyngeal large, thick, triangular, with concave surface. Vertebrae about 50.

Genus Hemiramphus Cuvier, 1817.

Hemiramphus Cuvier, 1817, Rènge Animal, Ed. I, II.

Type .... *Hemiramphus brasiliensis* = *H. browni*

Characters: Body more robust than in *Hyporhamphus* and different in form, the sides of body being compressed and nearly vertical and parallel. Head and jaws as in *Hyporhamphus*. Dorsal longer than anal fin and inserted farther forward, its last ray more or less produced in American species. Ventral fins small and inserted well backward, much nearer base of caudal than gill opening. Air bladder cellular, with many partitions.

Key to the Japanese species of Hemiramphus

a¹. Anal and dorsal fins jhst opposite each other; scales 108. .... **H. sajori**
a². Anal. fin slightly in advance of dorsal fin; scales 70–80. .... **H. kurumeus**

95. Hemiramphus sajori Temminck et Schlegel.
"Sajori"
(Text-figs. 100, a–c)

Hemiramphus sajori Temminck et Schlegel, 1846, Fauna Japonica, Poiss., p. 246, pl. cx, fig. 2. – Bleeker, 1853, Verh. Bat. Gen., xxv, Japan, p. 116. – Jordan et Thompson, 1914, Mem. Carn. Mhs., vol. vi, no. 4, p. 238.
Hyporhamphus occipitalis Gill, 1859, Proc. Ac. Nat. Sci. Philia., p. 148.
Hyporhamphus sajori Jordan et Snyder, 1900, Proc. U. S. Nat. Mus., vol. xxiii, no. 1213, p. 351. – Jordan et Snyder, 1901, Ann. Zool. Jap., vol. iii, p. 60. – Jordan et Starks, 1903, Proc, U. S. Nat. Mus., xxvi, no. 1319, p. 533. – Seno, Kanegae et Higashi, 1908, Nihon-gyokai Zusetsu, p. 81. – Tanaka, 1911, Fishes of Japan, pp. 285–287, pl. lxxix, fig. 270; pl. lxxx, fig. 273. – Tanaka, 1921, Nihon gyogaku, p. 328, fig. 99. – Okada, Matsubara, et Uchida, 1935, Nihon Gyorui Zusetsu, p. 98, pl. 38, fig. 3. – Matsubara, 1955, Fish. Morph. & Hier., pt. 1, pp. 386–387.

The original description* is as follows:

Hemiramphus Sajori.
Pl. CX, fig. 2.

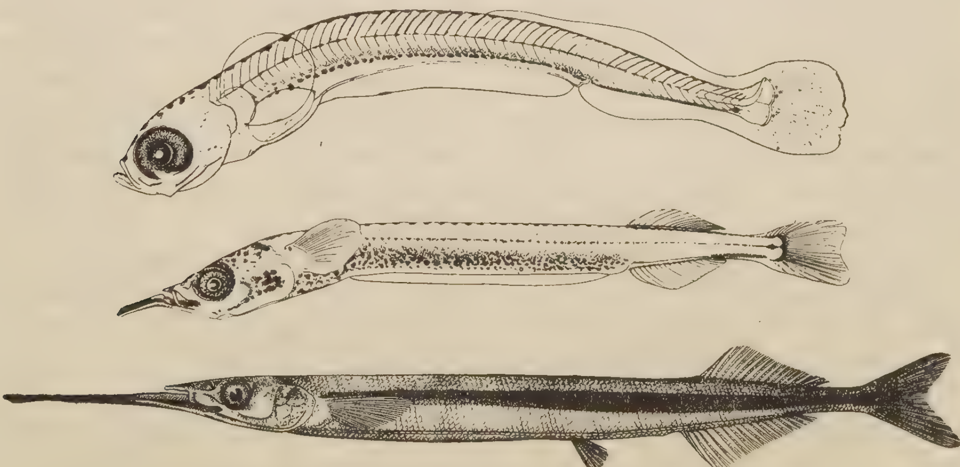
Cette espèce inédite offre des formes plhs allongées que celles décrites jusqu'a présent; elle se distingue en outre de l'*Hemiramphus longirostris*, Cuv., Règne animal II, p. 286, lequel est le Kuddera C de Russell, Pl. 178, par son bec plus court et par un plus grand nombre de rayons à l'anale, earaetère qui l'éloigue également des *Hemiramphus gambarus* et far, Rüppell, N. W. l. e., p. 74, et de l'*Hemiramp-*

*Temminck & Schlegel, 1846, Fauna Japonica, Poisson., p. 246.

hus marginatus de Lacépède, tome V, Pl. 7, fig. 2.

La hauteur du trone de ce poisson est environ neuf fois dans la distance comprise entre le bord postérieur de l'aeil et la caudale. Le diamètre transversal du tronc égale deux tiers de sa hauteur. L'aeil est de grandeur moyenne, son diametre égale la distance comprise entre son bord antérieur et l'angle de la bouche. L'entre-deux des yeux est un peu plus considérable que le diamètre de cet organe. La mâchoire supérieure est d'un tiers plus longue que le reste du museau, et elle est trois fois et demie dans la mâchoire inférieure. La forme de ces mâchoires et les dents dont elles sont armées n'offrent rien de particulier. L'anus s'ouvre vers la fin du troisième quart de la longueur totale du poisson. Les écailles sont de grandeur movenne. Il existe, comme d'ordinaire, deux lignes latérales, l'une rapprochée de la ligne du ventre, l'autre moins apparente est rapprochée de celle du dos.

Les pectorales naissent sus le milieu du corps, à une distance peu considérable derrière l'opercule; leur hauter est un peu moinder que la hauteur du tronc. Les ventrales, de plus d'un quart plus petites que les pectorales, naissent sur la fin du deuxièe tierr de la distance compeise entre la base des pectorales et l'anus. L'anale commence immediatement derrière l'anus; elle est par derrière de deux tiers moins haute que par devant. La dorsale correspond par sa forme, son étendue et sa position à l'anale. Le caudale est un peu échancrée à l'extrémité, et son lobe inférieur est un peu plus développé que le supéeieur. D. 16; A. 17; V. 1+5; P. 14; C. 18.



Text-figs. 100. a. Larva of ***Hemiramphus sajori*** TEMMINCK et SCHLEGEL. 6.5 mm. in total length, after K. UCHIDA.
b. Young of ***Hemiramphus sajori*** TEMMINCK et SCHLEGEL. 17.4 mm. in total length, after K. UCHIDA.
c. ***Hemiramphus sajori*** TEMMINCK et SCHLEGEL. × 1

Le dos de ce poisson est à l'état frais d'un verdâtre sale, les côtés sont bleuâtres et les parties inférieures, blanchâtres. La ligne latérale supérieure est marquée d'une raie d'un bleu-verdâtre, accompagnée par en bas d'une raie plus large d'un blanc argenté. Les nageoires sont grisâtres; mais les pectorales, la dorsale et la caudale tirent au noirâtre vers leur extrémité. Les bords des mâchoires sont également teintes de cette couleur. L'intérieur de la bouche, au contraire, est comme dans les Orphies, d'un beau vert-bleuâtre clair.

Ce poisson porte ordinairement dix pouces en longueur. Son. nom japonais est *Sajori*. On en prend beaucoup au printemps, dans de grands rets, dans l'intérieur de la baie de Nagasaki; cette pêche ayant lieu dans la nuit, on éclaire alors les berques au moyen de flambeaux. Sa chair est très-recherchée. On la transporte, soit sechée, soit salée, jusque loin dans l'intérieur des terres.

Description: Head from front tip of upper jaw to edge of opercle $4\,^4/_5$, depth of body 12, in total length $2\,^1/_2$, depth of caudal peduncle $5\,^1/_6$, distance from angle of mouth to tip of lower jaw a little more than 1, longest rays of pectoral 2, in head as measured from tip of upper jaw to edge of opercle. D. 16; A. 17; P. 13; V. 6; C. 4, 13, 3; scales in a longitudinal series 106.

Body elongate, not much compressed; outlines at back and belly almost parallel, gradually converging toward tip of head or caudal peduncle from middle of body; caudal peduncle rather slender, compressed. Head moderately large, with evenly curved upper and lower profiles; eye large, high, lateral; interorbital broad, slightly convex; snout with obliquely directed, straight profile and pointed tip; nostrils of same side fused, with a projecting flap at middle; lower jaw much longer than upper, which is longer than broad. Teeth in jaws small, tricuspid, in narrow, villiform bands; no teeth on vomer or palatines; gill membranes separate, free from isthmus; pseudobranchiae obsolete; gill rakers on first gill arch rather short, slender, close-set, 6 + 14, the longest being 2 in diameter of eye. Dorsal and anal placed posteriorly, opposite to each other and of about same length; base of dorsal equal to distance from tip of upper jaw to posterior of eye; pectoral placed rather high, pointed; ventrals inserted midway between anterior margin of eye and tips of median caudal rays; vent directly in front of eye; caudal emarginate, lower lobe the longer, as long as base of dorsal. Scales rather deciduous, cycloid; head scaled except snout, beak, throat, and branchiostegal membranes; lateral line running very low, interrupted posteriorly.

Color in spirits: brownish above, silvery below lateral stripe, lighter beneath; a bluish distinct stripe which broadens beneath dorsal fin. Sides of head silvery; mandible black; top of head and upper jaw dusky or black. Dorsal and caudal fins light brown, with darker margin; other fins colorless.

Habits: The present species is widely distributed along the coast from Hokkaidô in north to eastern China and Formosa, and is especially common in southern parts of Japan and Korea. The spawning season, extending from the middle of April to the middle of August, is usually at its height in May and June.

The demersal eggs, measuring 2.1 to 2.4 mm. (in average 2.2 mm.) in diameter, bear a filament on the egg-membrane as long as 30 times the diameter of egg, and a bunch of shorter filaments about 10 times as long as the egg diameter, 4 or 5 rarely 6 or 7 in number, on the opposite side of the egg. By these filaments, which are adhesive, the eggs become intertwined and attached in masses to the sea-weeds. The lower jaw is very short in the early larval stage, but grows longer very rapidly as the postlarval transform to the young fish stage. The food consits of various zooplankton, especially small crustaceans. After the young stage, this fish very often leaps out of the water in an effort to escape predators. This fish, sometimes inhabits brackishwater, or even ascends rivers far from their estuaries, to live in entirely freshwater, where the current is very slow.

Type locality............Nagasaki.

Distribution: Nagasaki; Matsushima; Aomori; Same; Tokyo; Misaki; Wakanoura; Kôbe; Hakata (JORDAN & STARKS); Nagasaki (SCHLEGEL); Nagasaki (BLEEKER); Toshima, Tôkyô (ISHIKAWA); Shimoda (GILL); Yokohama; Nagasaki (JORDAN & SNYDER); Kôbe (JORDAN & THOMPSON); Sapporo market, Otaru market, Hokkaidô; Tôkyô; Ôsaka; Nagoya market; Mikawa Bay; Toyama; Miyazu; Misaki (JORDAN & HUBBS); Tôkyô (JORDAN & SNYDER);

96 Hemiramphus kurumeus (JORDAN et STARKS).

"Kurume sajori"

(Text-figs. 101, a–c)

Hyporhamphus kurumeus JORDAN et STARKS, 1903, Proc. Nat. Mus., vol. XXVI, no. 1319, pp. 534–535, fig. 1. – TANAKA, 1921, Nihongyogaku, p. 328. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 205. – UI, 1932, Kisyu Gyofu, p. 74. – TOMIYAMA, 1934, Zool. Mag., 46 (551), pp. 401–410. – UCHIDA, 1935, Zool. Mag.' 47 (558), pp. 231–235, fig. 1. – OKADA et NAKAMURA, 1948, Nihon no Tansuigyorui, pp. 190–191, fig. 120. – MATSUBARA, 1955, Fish Morph. et Hier., pt. 1, p. 386.

Hemirhamphus kurumeus TANAKA, 1936, – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 187–188, fig. 159.



Text-fig. 101. a. Larva of ***Hemiramphus kurumeus*** (JORDAN et STARKS), 4.8 mm in total length, after K. UCHIDA.
b. Young of ***Hemiramphus kurumeus*** (JORDAN et STARKS), 17.6 mm. in total length, after K. UCHIDA.
c. ***Hemiramphus kurumeus*** (JORDAN et STARKS). × 2/3

The original description* is follows:

Hyporhamphus kurumeus JORDAN and STARKS, new species

Head from tip of upper jaw 5 in length; depth 10 to 11. Dorsal 15 or 16; anal 17 or 18; scales 70. Body not much compressed, the depth appearing greatest just behind opercles. Lower jaw from

* JORDAN et STARKS, 1903, Proc. U. S. Nat. Mus., vol. XXVI, no. 1319, pp. 534–535, fig. 1.

tip of upper half length of head; upper jaw slightly longer than wide. Teeth in upper jaw in a straight band at extreme sides, becoming broader anteriorly, those in lower jaw in a band narrower than the band at front of upper jaw and becoming narrower anteriorly. Eye equal to interorbital space, and contained twice in postorbital part of head. Gill rakers slender, scarcely as long as pupil, 7+19 in number.

Scales on top of head extending to snout. They are scarcely imbricated, circular, and with concentric striations, which form complete circles; similar scales on sides of mandible; from 47 to 50 scales in a median stripes on back between occiput and front of dorsal.

Pectoral rather slender and pointed, its length equal to eye and post-orbital part of head. Anal beginning slightly in advance of dorsal. Base of dorsal equal to head from anterior edge of preorbital. The tip of the last dorsal ray when declined reaches to within a distance equal to the diameter of the eye of the base of the upper caudal rays and a point at the middle of opercle. The lower lobe of the caudal is the longer; its length equals that of pectoral, and is two-thrds the diameter of the eye, longer than the upper lobe. The caudal is not deeply forked, the middle rays equal the postorbital part of the head.

Table 98. Measurements of *Hemiramphus kurumeus* JORDAN et STARKS.

Collection	O. H. B. S.*	
Total length	12. 4mm.	12. 7mm.
Body length	11. 30	11. 5
Body length/Head	4. 70	4. 42
Body length/Depth	1. 03	1. 15
Body length/Predorsal length	1. 45	1. 39
Body length/Prepectoral length	5. 94	5. 23
Body length/Preventral length	1. 85	1. 83
Body length/Preanal length	1. 45	1. 49
Head/Snout	8. 00	6. 50
Head/Upper jaw	2. 40	2. 60
Head/Interorbital width	4. 00	5. 20
Head/Diameter of Eye	4. 80	5. 20
Head/Length of Caudal peduncle	1. 00	1. 18
Head/Depth of Caudal peduncle	6. 00	6. 50
Head/Length of Dorsal fin	3. 00	3. 25
Head/Length of Anal fin	3. 43	3. 72
Head/Height of Dorsal fin	3. 00	3. 25
Head/Height of Anal fin	2. 67	2. 89
Head/Pectoral length	1. 60	1. 73
Head/Ventral length	2. 67	2. 89
Date	IV. 1915	
Locality	Kasumigaura, Ibaraki Prefecture	

* Ôtsu Hydrobiological Station attached to Kyôto University.

No silvery pigment remains upon the body except along the lateral stripe, which is very conspicuous, much broader posteriorly than anteriorly, and bordered above by a dark line; back sparsely covered with small dark brown points, which sometimes outline the scale pouches; they usually arrange themselves in three lines medially along the back; opercles bright silvery; top of head and upper jaw dusky, with black dots; a black blotch on mandible below maxillary; process of mandible jet black; fins all colorless except caudal, which is dusky.

In Kasumigaura, Ibaraki Prefecture, the present species comes into the lake from the sea, during March and April. The females deposit eggs several times during May and August. Thr number of eggs is 200 in a female measured 150–160 mm. in body length. The spawning ground is selected at a depth of 1.5–2 mm. off the caast. The eggs are deposited on soft weeds as "Sekishômô" (*Vallisneria spiralis*) L. var. asiatica MAKINO and "Kuromo" (*Hydrilla verticillata* CASP. var. *Roxburghii* CASP.). The

Ara River, Tôkyô; Nagoya; Ariake Sea, (OKADA & NAKAMURA); Igunuma, Rikuzen Province (TANAKA & KUMAGAYA); Kasumigaura; Ibaraki Prefecture (JORDAN & STARKS); River Tone; Ibaraki Prefecture (AOYAGI); Korea (UCHIDA).

Remarks: This is a freshwater species and confused very often with common *Hemiramphus sajori.* The present species is somewhat smaller than the latter and pelagic in life. It feeds on small animals and spawns in spring. Many filaments existing on the egg membrane, by those the egg attached in masses to the weeds.

This is distributed in southwest of Lake Kasumigaura in Honshû and also the coast of Korea, from the vicinity of Fusan to westward of Chinkai Bay.

According to TANAKA (1931) and TOMIYAMA (1934), *Hemiramphus sajori* T. et SCH. and *H. kurumeus* (J. & S.) are considered to be inseperable by distinctive characters, while UCHIDA (1936)* treated both species in two separate species.

The latter author distinguished two separate species by the number of scales in longitudinal series, number of vertebrae and the formula and total number of gill-rakers. Among these characters above-mentioned, the number of vertebrae may be considered as a decisive feature in specific distinction. He has remarked further the characteristics treated unstatistically as the length of pectoral fin, melanophore distribution on the scales arranged on the dorso-lateral side of body, and the color of the tip of lower jaw (in fresh state). As to the ecological aspects, *H. kurumeus* lives chiefly in the brackish or freshwater, whereas *H. sajori* lives usually in the sea. A land-locked case of the former species has recently been found in southern Korea in an absolutely fresh water swamp in which it propagates well.

Order Gatrosteida

Characters: Interclavicle developed. Gills pectinate. Post-temporal simple, not furcate; supraclavicle quite small. Superior pharyngeal bones reduced in number, the bones of the gill arches also reduced except in Gasterosteidae; inferior pharyngeals present, not united. Ventral fins abdominal or subabdominal, joined to the interclavicle, or else detached from it through partial atrophy of the shoulder girdle. Mouths bounded above by premaxillaries only; shoulder girdle simple in structure. Basis of cranium simple and without tube; four anterior vertebrae more or less elongate; snout usually more or less produced, the small mouth at its end. A small group, well distinguished from the *Percesoces* and other *Teleocephali*, from acestors of which it is probably descended, differing in the presence of the interclavicles and in the reduction of the shoulder girdle and other structures.

Family Gasterosteidae

Characters: Body more less fusiform, somewhat compressed, tapering behind to a slender caudal peduncle. Head moderate, the anterior part not greatly produced, but all the bones of the suspensory apparatus somewhat lengthened. Mouth moderate, with

the cleft oblique, the lower jaw prominent; maxillary bent at right angles and overlapping the premaxillary at corner of mouth. Teeth sharp, even, in a narrow band in each jaw; no teeth on vomer or palatines; premaxillaries protractile. Preorbital rather broad, suborbital plate large, often covering the anterior part of the cheeks, forming a connection with the preopercle. Branchiostegals, 3. Gill membranes broadly joined, free from the isthmus, or not; gill rakers moderate or rather long. Opercles unarmed. Skin naked or with vertically oblong bony plates; no true scales. Dorsal fin preceded by two or more free spines; anal similar to soft dorsal, with a single spine; ventral fins subabdominal, consisting of a stout spine and one or two rudimentary rays. Middle or sides of the belly shielded by the pubic bones. Pectorals rather short, unusually far behind the gill openings, preceded by a quadrate naked area, which is covered with shining skin. Caudal fin narrow, usually lunate. Air bladder simple; a few pyloric coeca. Vertebrae 30 to 35; anterior vertebrae little enlarged. Genera 5; species about 12.

Key to the Japanese genera of Gasterosteidae

a[1] Gill openings confluent, the gill membranes forming a broad free margin across the isthmus. .... **Pungitius**

a[2] Gill coenings restricted, the membranes mesially united to the isthmus; dorsal with two free spines; skin mailed, partly mailed, or naked. .... **Gasterosteus**

Genus Gasterosteus (ARTEDI) LINNAEUS

Gasterosteus (Artedi), LINNAEUS, Syst. Nat., X, 1758, 489, (*aculeatus*).
Gasteracanthus, PALLAS, Mem. Ac. St. Petersb., III, 325, 1811.
Leiurus, SWAINSON, Nat, Hist. Class'n Fishes, II, 242, 1839.

Characters: Sticklebacks with the innominate bones coalescent on the median line of the belly, behind and between the ventral fins, forming a triangular or lanceolate plate. Gill membranes united to the isthmus. Tail slender, and usually keeled. Skin variously covered with bony plates. Dorsal spines 3 in number, strong, with nondivergent bases. Species numerous. Freshwaters and shores of all northern regions; the species highly variable, those found in the sea usually with the body completely mailed, the fresh and brackish water forms variously mailed or even altogether naked. It is probable that the reduction in armature is in some degree connected with life in freshwaters.

Key to Japanese species of Gasterosteus

a[1] Plates 32–35 in trachura type of anadromous form, mostly 34 in number.
Plates 18–34 in trachura and semiloricata types of land-locked form, mostly 31–34 in number. .... **G. aculeatus aculeatus**

a[2] Plates 2–7 anteriorly (gymnura type), mostly 4 and unfrequently 5–6 in number. Land-locked form. .... **G. aculeatus microcephalus**

* UCHIDA, K. 1936, Zool. Mag., 48(6), pp. 295–306, figs. 1–8.

Key to Japanese species of Gasterosteus

a[1] Plates 32-35 in trachura type of anadromous form, mostly 34 in number.
Plates 18-34 in trachura and semiloricata types of land-locked form, mostly 31-34 in number. .... **G. aculeatus aculeatus**

a[2] Plates 2-7 anteriorly (gymnura type), mostly 4 and unfrequently 5-6 in number. Land-locked form. .... **G. aculeatus microcephalus**

97. Gasterosteus aculeatus aculeatus (LINNAEUS).
Sticklebacks, Needle fish, "Togeuo, Hariuwo, Itouwo, Itoyo"
(Text-fig. 102, a–c)

Gasterosteus aculeatus LINNAEUS, 1758, Systema Naturae Tomus. I, p.p. 295-296. - HECKEL et KNER, 1858, "Süsswass. Oestr. p. 38. - DAY, 1880-1884, Fish. Great Britain & Ireland, p. 238, pl. LXVIII, figs. 1-3. - SMITT, 1895, Scandin. Fish., 11, p. 647. - JORDAN et EVERMANN, 1896, Fish. N. America, L, p. 747. - BERG, 1916, Les Poissons des eaux douces de la Russie, pp. 463-465, fig. 351. - REGAN, 1909, Ann. Mag. Nat. Hist., (8), iv, pp. 435-437. - ISHIKAWA, 1897, Prel. Cat., p. 58. - JORDAN et HUBBS, 1925, Mem. Carn. Mus., aol. x, pp. 201-202. - KOBAYASHI, 1932, Journ. Sc. Hiroshima Univ. ser. B, vol. L, art 8, pp. 147-148, pl. L, fig. 1.

Gasterocanthus cataphractus PALLAS, 1811, Zoographia Rosso Asiatica vol. iii, p. 229.

Gasterosteus cataphractus JORDAN et EVERMANN, 1898, Fishes N. and M. Amer., L, p. 747-748.. - JORDAN et STARKS, 1902, Proc. U. S. N. Mus., vol. xxvi, no. 1308, pp. 59-60. - TANAKA, 1908, Ann. Zool. Jap., vol. vi, no. 4, p. 239. - JORDAN, TANAKA, et SNYDER, 1913, Cat. Fish. Jap., p. 104. - TANAKA, 1921, Nihon Gyogaku, pp. 237-238, fig. 70.

Gasterosteus obolarius CUVIER et VALENCIENNES 1829, Hist. Nat. Poiss., IV, p. 500.

Gasterosteus insculptus RICHARDSON, 1854, Last Arctic Voyage, p. 10, pl. xxv, figs. 1, 2, and 3.

Gasterosteus serratus SYRES, 1855, Proc. Cal. Acad. Sci., p. 47.

Gasterosteus intermedius GIRARD, 1856, Proc. Acad. Nat. Sci. Phila., p. 135.

Gasterosteus aculeatus cataphractus JORDAN et GILBERT, 1883, Synopsis p. 396.

Gasterosteus williamsoni GIRARD, 1854, Proc. Acad. Nat. Sci. Philad., p. 103.

Gasterosteus microcephaus GIRARD, 1854, Proc. Acad. Nat. Sci., Philad., pp. 133-134.

Gasterosteus inopinatus GIRARD, 1854, Proc. Acad. Nat. Sci., Philad., p. 147.

Gasterosteus pugetti GIRARD, 1856, Proc. Acad. Nat. Sci., Philad., pp. 135-136.

Gasterosteus bispinosus JORDAN et EVERMANN, 1896, Fish. N. America, p. 748.

Gasterosteus (aculeatus) gymnurus FATIO, 1882, Poiss. de la Suisse. L, p. 71.

Gasterosteus brachycentrus HAECKEL et KNER, 1858, Susswass. Oestr. p. 41, pl. 17.

Gasterosteus biarmatus NARDMANN, 1840, Fauna pontique, p. 381.

Gasterosteus ponticus NARDMANN, 1840, Fauna pontique, p. 380.

Gasterosteus trachurus CUVIER, 1829, Regne Anim., ed. 2, t. Li, p. 170. - CUVIER et VALENCIENNES, 1829, Hist. Nat. Poiss., iv, p. 481.

Gasterosteus aculeatus aculeatus KOBAYASHI, 1932, Journ. Sci. Hiroshima Univ., ser. B, Div. 1, vol. 1, art. 8, p. 148, pl. 1, fig. 2. - IKEDA, K., 1933, Zool. Mag., 45 (534), pp. 142-147. - MIYADI, 1935, Kyôto fuka no Tansuigyo, p. 37, pl. 5, fig. 38. - IKEDA, H., 1936, Suisan Kenkyûshi, vol. 32, no. 1, pp. 1-2, figs. 1-2. - OKADA et IKEDA, 1938, Sci. Rep. Tokyô Bun. Daig., sect. B, no. 55, pp. 149-150. - OKADA et NAKAMURA, 1948, Nihon no Tansuigyorui, pp. 188-189, fig. 117. - AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 178-182, figs. 151-154.

The original description is as follows:

145. *Gasterosteus.** *Caput.*

Membr. branch. radüs III, Arted.

Corpus ad caudaw utrinque carinatum. *Aculer* distincti anto pinam dorsi.

aculeatus 1. G. Spinis dorsalibus tribus. *Art. gen. 52. syn. 80. spec. 26 Fn. svec. 276.* D. 3, 12. P. 10. V. $^{1}/_{2}$ A. $^{1}/_{9}$. C. 12.

Habitat in Europa.

Ductor. 2. G. spinis dorsalibus quatuor.

B. 7. D. 4, 27. P. 18. V. 6. A. 16. C. 19.

Hasselqv. iter. 366. Scomber Ductor

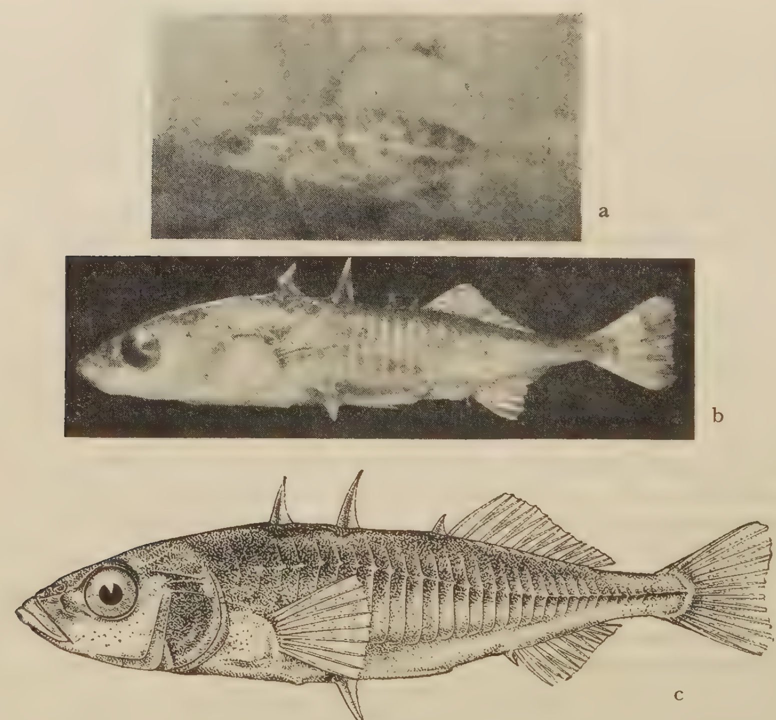
D. $^{4}/_{28}$. P. 20. V. 5. A. 16. C. 16.

Osbeck. iter. 73. Scomber Ductor

D. $^{3}/_{30}$. P. 19. V. 5. A. 16. C. 26.

.... Act. Stockh. 1755. p. 71.

idem



Text-fig. 102. a–c. ***Gasterosteus aculeatus aculeatus*** (LINN.).

a. Living ***Gasterosteus aculeatus aculeatus*** (LINN.). in aquarium at Inokashira, Tokyo. ♀

b. Misformed ***Gasterosteus aculeatus aculeatus*** (LINN.). with four dorsal spines from Ozenuma, Aomori Prefecture. ♂

c. ***Gasterosteus aculeatus aculeatus*** (LINN.).

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* C. LINNAEUS 1758, Systema Naturae. Tomus. I. p. b. 295–296.

Habitat in Pelago, *Satelles Squali.*

Medius quasi inter Gasterosteos & *Scombros*; *at convenit cum illis spinis. Ante pinnam dorsalem distinctis* & *cum G. Pungitio caudae lateribus carinates, gnamvis differat a Gasterosteis. Membrana branchiostega.*

Habitat in America Mus. De Geer.

ovatus. 4. G. dorsalibus septem:

prima recumbente, corpore ovato.

B. 6. D. 7, 20. P. 16. V. 6. A. 2, $^{1}/_{17}$. C. 20.

Habitat in Asia.

Pisciculus *ovato oblongus, compressus, figura Chaetodontis. Maxillae and Cabiorum dentes scabri. Spinae in dorso 7 ante pinnam doralem. rəd disstinctae and alternatim ad latera directae: harum prima minima. 2: da paulo longior. Spinae 2 validae ante pinnam ani. Differt a Gasterosteis reliquis membr. branch. radüs 6, nec 3*; *caret scutello thoracis offeo, an itaque Labris*

Table 99. Measurements of *Gasterosteus aculeatus aculeatus** (Linn.).

Reg. No.	Total length	Standard length	Depth body	Head	Eye	Length of 1st dorsal spine
mm.	mm.	in L.	in L.	in H.	in H.	in H.
1385	40.6	36.5	4.7	3.1	3.4	3.4
—	44.7	40.1	4.3	3.1	3.3	2.8
—	69	63.5	4.7	3.1	3.8	3.5
—	82	75	5.0	3.1	4.5	4.1
5949	80.7	71.6	4.6	3.2	4.1	?
—	83.8	73.3	4.7	3.0	4.3	2.5
—	91.3	82.1	4.5	3.5	4.1	2.5
—	94.4	84.8	4.7	3.5	4.0	2.8
17244	78.7	71.1	5.0	3.2	3.9	2.7
—	80.0	71.3	5.2	3.1	4.1	2.4
—	82.9	75.0	4.7	3.5	4.3	3.3
18551	91.0	83.4	5.0	3.5	4.4	3.0
20159	76.5	67.3	4.8	3.1	3.8	2.5
—	76.9	68.3	5.2	3.2	3.9	2.6
—	84.5	74.5	4.6	3.4	3.8	3.0
—	86.6	78.8	4.4	3.3	4.4	2.9
—	90.1	79.7	4.8	3.5	4.0	2.8
26103	52.3	46.7	4.4	2.9	4.1	4.9

Length of ventral spine	Distance between ventrals pine & spine	Number of scute	Sex
in H.	in H.		
2.2	1.3	3″-1″,1-4,1′-26′	♀
1.9	1.2	3″-1″,1-4,1′-26′	♀
2.3	1.2	3″-1″,1-4,1′-27′	♀
2.7	1.1	3″-1″,1-4,1′-26′	♀
2.0	1.3	3″-1″,1-4,1′-27′	♂
2.1	1.4	3″-1″,1-4,1′-26′	♀
1.9	1.0	3″-1″,1-4,1′-26′	♀
1.9	1.0	3″-1″,1-4,1′-27′	♂
2.2	1.3	3″-1″,1-4,1′-27′	♂
2.2	1.4	3″-1″,1-4,1′-27′	♂
2.3	0.9	3″-1″,1-4,1 -27′	♂
2.0	1.0	3″-1″,1-4,1 -27′	♀
2.2	1.83	3″-1″,1-4,1 -25′	♂
2.1	1.2	3″-1″,1-4,1 -27′	♂
2.0	1.0	3″-1″,1-4,1 -26′	♀
2.1	1.1	3″-1″,1-4,1 -28′	♀
2.2	1.0	3″-1″,1-4.1′-26	♀
3.1	1.5		♂

* These specimens are preserved in Saitô Hô-on Kai Museum, Sendai Miyagi, Prefecture.

annumerandus vel tero Gasterocsteis. Pina prima dorsi antrorsum decumbens fixa, uti in Scombris quibusdam.

Pungitius 5. G. spinis dorsalibus decem.

Art. gen 52. syn. 80 spec.

97. *Fn. svee. 277.* D. 10, 11, P. V. 1, A. 11, C ....

Habitat in Europa.

Description: Head $3\,^1/_2$; depth $4\,^1/_2$; eye $3\,^4/_5$. Dorsal 11–1, 13; anal 1, 10. Body slender, compressed; head small and pointed; mouth oblique, maxillary not reaching eye; caudal peduncle depressed, keeled. Processes from shoulder girdle slightly divergent, leaving a narrow, naked area on breast; naked area in front of pectorals equal to length of snout. Dorsal spines long and slender, the length equaling dintance from snout to pupil; third dorsal and anal spines very small, curved; ventral spines long, slender, as long as snout and eye, or even longer in some specimens; serrate at base and with basal cusp; ventral plate as long as spine in many specimens, narrow, the greatest width $3\,^1/_2$ in length. Lateral armature complete, plates gradually reduced in size posteriorly, forming distinct caudal keel. Dark grayish or bluish black above, silvery below, with a few dark punctuations, thickest on caudal peduncle and near tip of ventral spines.

Table 100. a. Measurements of *Gasterosteus aculeatus aculeatus** (Linn.).

Locality	Sex	Total length	Body length	B.L./B.H.	Head length	B.L./H.L.	Diameter Eye
(*marine form*)	♂	73	62	4.4	19	3.3	5
Hokkaidô (Ibarato)	♀	80	62	4.2	19	3.4	5
— (Nemuro)	♀	97	84	4.4	24	3.5	5
Aomori (Aisaka)	♂	78	68	3.8	22	3.1	5
Akita (Hanadate)	♀	80	68	4.5	20	3.4	5
	♂	80	70	4.8	22	3.2	5
Iwate (Hamaishi)	♀	87	75	4.1	22	3.4	5
Miyagi	♂	82	72	4.2	23	3.1	5
Fukushima (Onahama)	♂	80	68	4.3	21	3.2	5
Ibaraki (Hinuma)	♀	80	71	3.6	20	3.6	5
—	♂	72	63	4.5	19	3.3	5
— (Kasumigaura)	♀	74	65	4.3	21	3.1	5
Niigata (Niigata)	♂	75	64	4.3	19	3.4	5
	♂	83	72	4.5	22	3.3	5
Toyama (Uozu)	♀	95	82	4.5	23	3.6	5
	♂	82	71	4.4	22	3.2	5
Ishikawa (Kanazawa)	♀	90	79	4.5	22	3.6	5
	♂	76	65	4.3	20	3.3	5
Kyôto (Kyuhachie)	♀	86	76	4.6	20	3.8	5
Tottori (Awashima)	♂	75	64	4.3	19	3.4	5
Shimane (Hamada)	♂	75	67	4.4	20	3.4	5
	♂	77	67	4.2	20	3.4	5
	♀	86	75	4.2	22	3.4	5
(*landrocked form*)							
Fukushima (Tajima)	♂	51	43	3.9	14	3.1	4
	♀	28	49	3.9	15	3.3	5.5
— (Kitakata)	♂	54	45	3.6	15	3.0	4
Ibaraki (Oyazono)	♂	38	31	3.3	11	2.8	3
	♀	52	44	3.5	14	3.1	4
Fukui (Ono)	♂	63	53	3.6	19	3.1	5
	♀	66	56	3.4	1.8	3.1	5

* These specimens were measured by K. Ikeda in 1933.

Habits: In 1932, KOBAYASHI* mentioned the general observation of Japanese Gasterosteiid Fish and stated the habits as follows. "The *Gasterosteus aculeatus aculeatus*, a stickleback of fresh and brackish water, lives mainly in the deep water of rivers, marshes, inlets, and lagoons, and early in February migrates for reproduction to streams or paddy fields of freshwater plants where the water always flows slowly. Nest-building, spawning and the male's care of the young fry take place in the freshwater between March and May, and early in June the adult fish returns to the former place, though his fry still remain in shoals until their migratory season early in September comes. But in the farther northern forms, as the nuptial season begins later, so the seasonal migration begins later also. The nest is made more or less flatly with roots and stems of water plants which have come off and been softened; and the greater part of the nest is buried in the muddy bottom of the stream or paddy field. As far as my observation goes, every nest has only one pore almost in the center of its top which appears on the mud. The nuptial colors of the male are brilliant with their ventral sides of vermillion-red. This

Table 100. b. Measurements of *Gasterosteus aculeatus aculeatus** (LINN.).

Length ant. spine dorsal	Length ventran spine	H. L. / V. S.	Length L. P.	L.L.P. / B.L.P.	Distance between Dorsal spine anal spine
7.4	10.5	1.84	10.6	3.3	14
6.9	10.7	1.80	12.5	3.2	19
9.0	12.5	1.92	13.5	3.4	24
5.5	10.0	2.20	11.0	3.8	16
5.5	10.0	2.00	12.0	3.0	18
7.1	10.5	2.09	10.5	2.8	16
7.0	11.3	1.92	13.0	3.3	20
9.0	11.0	2.09	12.0	3.0	20
8.0	10.0	2.10	11.5	3.3	17
6.0	9.5	2.11	11.0	2.8	20
7.0	10.0	1.90	10.0	2.9	16
6.0	8.0	2.63	10.0	3.3	16
8.0	10.0	1.90	11.0	3.7	15
8.5	11.2	1.96	12.2	3.5	20
7.8	11.8	1.91	13.3	3.3	24
8.5	11.0	2.00	11.7	3.3	17
8.1	12.5	1.76	13.2	3.3	23
7.6	10.5	1.90	10.7	3.2	16
7.0	10.9	1.87	12.6	3.0	22
8.0	10.0	1.90	11.0	3.7	15
7.0	10.0	2.00	11.0	3.7	15
7.0	10.0	2.00	11.0	3.6	19
7.0	11.0	2.00	12.5	3.1	24
3.0	5.5	2.55	6.1	2.2	11
3.3	5.5	2.27	7.0	2.1	15
3.0	4.3	2.48	5.0	1.7	11
2.5	5.0	2.20	5.0	2.5	10
3.0	6.0	2.33	7.5	1.7	13
3.5	6.5	2.92	7.8	1.7	14
4.0	7.4	2.43	6.5	1.6	11

Abbreviation: - B.L.—Body length, B.H.—Body height, H.L.—Head length, V.S.—Ventral spine, L.P.—Latteral plate, L.L.P.—Length of Laeral plate, B.L.P.—Breadth of Lateral plate.

* KOBAYASHI, 1932, Journ. Sci. Hiroshima University, ser. B, Div. 1, vol. 1, art. 8, pp. 150–151.

nuptial colour appears at first on the branchiostegal region, and when the sexual season is over their colorations fade.

Generally the present species is small and voracious, descending in large shoals to the estuaries or even the sea. It feeds on worms, larvae, small crustaceans, shrimps and own eggs. The males appear to be always ready for a fight after finishing the spawning by the females. They usually commences breeding so in April or May.

K. IKEDA** stated the present species is a typical trachurus type with perfectly developed scale plates and divided into two types marine form and landrocked form ecologically.

The Japanese species is chiefly a marine form ascending into rivers from sea in spring when the water temperature is raised. The migratory season is variable by the latitude, in the north somewhat delay than in the south. During the breeding season, it enters into streams and paddy fields after ascending the rivers, and makes a nest in calm and shallow waters.

The breeding season is also variable by locations. In Niigata districts, the northern part of Honshû, the season begins from the upper of April and ends to the end of June. The female may die after spawning and the male also die after the youngs can live independently. The youngs of 20–30 mm. body length descend into sea by forming a school. In Niigata districts, they begin to descend into sea in the middle of June and never remain in the end of July in the river when the water temperature raised 20° or more

Table 101. Measurements of *Gastrosteus aculeatus aculeatus* (LINNÉ).

Collection	O. H. B. S.*				
Total length	87.6mm.	86.0mm.	83.0mm.	78.0mm.	76.0mm.
Body length	76.0	76.0	75.0	70.0	69.0
Body length/Head	3.62	3.54	3.57	3.50	3.54
Body length/Depth	4.47	4.37	4.54	4.38	4.45
Body length/Predorsal length	1.65	1.69	1.74	1.63	1.62
Body length/Prepectoral length	2.86	2.86	2.86	2.80	3.00
Body length/Preventral length	2.10	2.32	2.27	2.29	2.46
Body length/Preanal length	1.43	1.43	1.44	1.40	1.44
Head/Snout	3.00	2.99	3.14	2.86	2.87
Head/Upper jaw	3.62	3.84	3.96	3.64	4.07
Head/Interorbital width	4.20	4.30	4.38	3.57	3.75
Head/Diameter of Eye	4.40	4.48	3.96	3.78	4.33
Head/Length of Caudal peduncle	2.62	2.62	2.69	2.67	2.29
Head/Depth of Caudal peduncle	7.50	7.17	7.00	7.69	7.50
Head/Length of Dorsal fin	0.88	0.88	0.88	0.92	0.95
Head/Length of Anal fin	1.48	1.43	1.54	1.43	1.63
Head/Height of Dorsal fin	2.10	2.15	2.21	2.22	2.17
Head/Height of Anal fin	2.62	2.62	2.69	3.34	2.78
Head/Pectoral length	1.40	1.45	1.38	1.35	1.35
Head/Ventral length	1.98	1.87	1.86	1.91	1.91
Date	IV, 1924				
Locality	Hokkaidô				

* Otsu Hydrobiological Station attached to Kyôto University

** IKEDA, K., 1933, Zool. Mag., 45 (534), pp. 142–147, figs. 1–3.

Distribution: The present species was said to distribute mostly in northern part of Japan inculding. Saghalien, Kurile Island, Hokkaidô, Honshhû, and eastern coast of Korea. The southern limit has been known Fusan, Korea (35°6′) on the Korean seacoast and Hamada, Shimane Prefecture (34°54′) on the coast of Japan Sea and Chôshi, Chiba Prefecture (35°44′) on the Pacific coast. But in 1936, we had a very good chance to observe the two specimens from Kyushû, one was caught at River Uragami, Nagasaki City (32°44′) on the end of March, 1936 and the other was obtained at River Ôita, Ôita City (33°15′) on the end of March 1936, by the courtesies of SABURO KURAMOTO, the teacher of Nagasaki Fisheries School and Mr. TSUNEJI SENDA, the teacher of Ôita Middle School. These specimens were described by H. IKEDA* one of my assistant in his paper titled on *Gasterosteus aculeatus aculeatus* (LINN.) obtained from Kyûshû in 1936. Perhaps at present, River Uragami, Nagasaki City may be the southern limit for the distribution in Japan. Labrador to New Jersey; New England (JORDAN, & EVERMANN); San Fransisco to Alaska, Kamtchatka (JORDAN, & EVERMANN); Fort Steilacoon, Puget Sound (G. SUCKLEY); Presidio, California (GIRARD); San Joaguin Valley, California (TROWBRIDGE); Ugo; Kusiro; Northern Japan; Puget-Sound; River Ibi and Mino River, Ôgaki (JORDAN & STARKS); River Suguya; Lososei Bay (TANAKA); Puget Sound; Shetland; Santa Clara River, California; British Isles, Northern Italy (REGAN); Kusiro, Hokkaidô (JORDAN, HUBBS); Lake Tomunai, Saghalien; Lake Ônuma; Coast of Siribesi; Lake Saroma to the Bay of Atukesi; Eastern coast of Hokkaidô; Etoro; Kunasiri; Aisaka, Aomori Prefecture; Coast of Sea of Japan from Aomori to Simane Prefecture (KOBAYASHI); Uragami River, Nagasaki Prefecture; Ôita River, Ôita Prefecture (IKEDA); Far North of Hamada, Japan Sea coast; far North fo River Tone in anadromous form; River Agano; Aizu, Tajima, Fukushima Prefecture; upper River Kuzuryû, Fukui Prefecture; Ono, River Naka, Ibaraki Prefecture; Nasu, Tochigi Prefecture (OKADA & NAKAMURA); Lake Ônuma; the coast of Siribeshi, Lake Saroma, Bay of Atsuekshi, Hokkaidô; shores of Island of Etoro; Kunashiri, Hokkaidô; Aisaka, Aomori Prefecture; Shimane Prefecture (KOBAYASHI); Kushiro, Onuma, Nemuro, Akkeshi, Hokkaidô; Aisaka, Fujisaka mura, Aomori Prefecture; Nobechi River, Nobechi, River Owatari, Kamaichi machi, Iwate Prefecture; Shikaori-mura, Motoyoshi-gun, Miyagi Prefecture; River Fujiwara, Ishiki-gun, Fukushima Prefecture; Hinuma, Kasumigaura, Ibaraki Prefecture; Hanadate, Senhoku-gun; Rokugo, Omagari machi, Akita Prefecture; Sakata, Tsuruoka, Yamagata Prefecture; River Shinano, River Agano, Niigata Prefecture; Uwozu, Toyama Prefecture; Kanazawa, Ishikawa Prefecture; Kitama, Hamatsumura, Ishikawa Prefecture; Maruta, Kasa-gun, Kyoto fu; Awashima, Seihakugun, Tottori Prefecture; Kitsukichô, Imaichichô, Hikawa-gun, Shimane Prefecture; Hamadachô, Shimane Prefecture (these are marine form); Tajima, Aizu-gun Fukushima Prefecture; Kitakata, Yamagun, Fukushima Prefecture; Araimura, Tateuchi mura, Kitaaizugun, Fukushima Prefecture; Fujikawa mura, Ônuma gun, Fukushima Prefecture; Nasu, Tochigi Prefecture; Mitori, Oyasono mura, Tochigi Prefecture; Otawara,

* IKEDA, H., 1936, Suisan Kenkyûshi, vol. 32, no. 1, pp. 1–2, figs. 1–2.

Tochigi Prefecture; Ôno, Fukui Prefecture (these are landrocked form) (K. IKEDA); Lake Kuchatro, Hokkaidô (K. IKEDA); Ôsaka, Aomori Prefecture; Tajima, Kitagata, Tateuchi-mura, Fujikawa-mura, Fukushima Prefecture; Nasuno, Tochigi Prefecture (IKEDA).

Remarks: JORDAN and STARKS made the observations of the number of soft rays of dorsal and anal fins and found some variations in each locality. They showed the following table to show the varied numbers of the soft rays of dorsal and anal fins.

Table 102. Varied numbers of the soft rays of dorsal and anal fins.

Locality	Ugo	Kushiro	N. Japan	Puget Sound	River Ibi	Mino.
Dorsal	14 13 13	12 11	13 14 13	13 12 14 12 14	12 11 13 12 11	11 11 12
Anal	11 10 10	9 8	10 9 9	9 9 10 10	10 9 9 9 8	8 9 8

98. Gasterosteus aculeatus microcephalus (GIRARD).

Little needle, "Hariuo, Harinko"

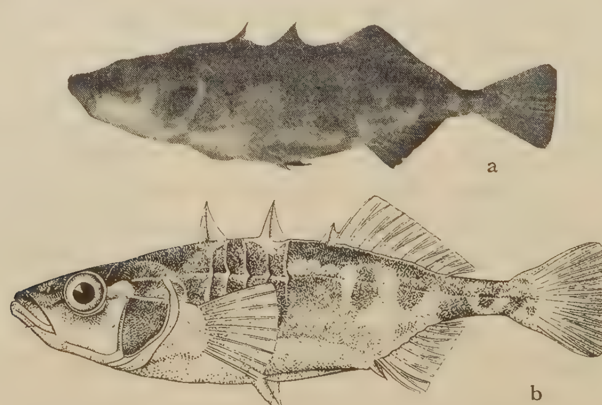
(Text-figs. 103. a–b)

Gasterosteus aculeatus microcephalus, JORDAN et HUBBS, 1925, Mem. Carn. Mus., p. 202. – KOBAYASHI, 1928, Journ. Sci. Hiroshima Univ., Ser. B, vol. 1, art., 8, p. 148. – IKEDA, K. 1933, Zool. Mag., 45 (534), pp. 147. – MIYADI, 1935, Kyoto fuka Tansuigyo, p. 37, – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 182–183, fig. 155.

Gasterosteus williamsoni japonicus FRANZ, 188 Beit. zur Naturg. Ostasien. p. 19, Taf. III, fig. 10. – TANAKA, 1921, Nihon Gyogaku, p. 238.

Gasterosteus cataphractus PALLAS, 1811, Mem. Acad Petersb., III, p. 325. – JORDAN, TANAKA, et SNYDER 1913. Cat. Fish. Jap. p. 104.

Gasterosteus gymnurus CUVIER et VAL., 1829, SHISHIDO, 1890,



Text-fig. 103. a–b. ***Gasterosteus aculeatus microcephalus*** (GIRARD). ×1

Description: Each side of the body anteriorly armed with bony plates, four in many and five in some, and the rest of body entirely naked.

Color dark green with irregular dark greenish blue stripes and bands, silvery white below.

Table 103. Measurements of *Gasterosteus aculeatus microcephalus** (GIRARD).

Locality	Sex	Total length	Body length	B.L./B.H.	Head length	B.L./H.L.	Diameter Eye
Landrocked form							
Shiga (Toyogo)	♂	54	45	3.8	16	2.8	4
—	♀	46	39	3.5	12	3.2	4
Gifu (Kano)	♂	51	43	3.5	15	2.0	4
—	♀	54	46	3.7	14	3.3	4
Mie (Nanatori)	♂	52	45	3.7	16	2.8	4

Length ant. Dorsal spine	Length ventral spine	H.L./V.S.	Length L.P.	L.L.P./B.L.P.	Distance between Dorsal spine & anal spine
3.3	5.5	2.82	6.5	1.6	11
2.0	5.0	2.40	6.0	2.1	11
3.5	6.0	2.57	7.5	1.8	11
3.0	5.6	2.57	8.4	1.8	13
3.5	5.5	2.91	8.0	1.6	13

*These specimens were measured by K. IKEDA in 1933.

Abbreviations:- B.L.—Body length, B.L.—Body height, H.L.—Head length, V.S.—Ventral spine, L.P.—Lateral plate, L.L.P.—Length of Lateral plate, B.L.P.—Breadth of lateral plate.

Table 104. Measurements of *Gasterosteus aculeatus microcephalus* (GIRARD).

Collection	O. H. B. S.*	
Total length	48.0mm.	50.0mm.
Body length	42.0	44.0
Body length/Head	2.90	3.14
Body length/Depth	3.44	3.38
Body length/Predorsal length	1.61	1.63
Body length/Prepectoral length	2.47	2.52
Body length/Preventral length	2.00	2.00
Body length/Preanal length	1.40	1.41
Head/Snout	2.90	2.92
Head/Upper jaw	3.63	3.50
Head/Interorbital width	4.14	3.79
Head/Diameter of Eye	3.92	3.50
Head/Length of Caudal peduncle	2.34	2.12
Head/Depth of Caudal peduncle	5.80	5.60
Head/Length of Dorsal fin	1.21	1.15
Head/Length of Anal fin	1.93	1.80
Head/Height of Dorsal fin	2.42	2.26
Head/Height of Anal fin	2.79	2.80
Head/Pectoral length	1.94	1.75
Head/Ventral length	2.50	2.16
Date	V, 1925	
Locality	Gifu	

* Ôtsu Hydrobiological Station attached to Kyôto University.

Fin formula: dorsal fin 3 spines and 11 rays; pectoral fin 10 rays; ventral fin 1 spine and 1 ray; anal fin 1 spine and 7 rays.

This subspecies is a stickleback of the clear brook variety of the southern region of Lake Biwa and of the neighbourhood of Gifu and Ôgaki.

Habits: The present subspecies is land-rocked form. Spawning season is in spring. It lives in clear streams and feeds on small aquatic animals. The male builds a cup-like nest. During summer the young descends a river into sea to grow and the adult ascends a river again in next March and May to spawn. After spawning, the adults mostly die. During the breeding season, the male shows a redish nuptial color. KOBAYASHI* has noted about the habits and seasonal migration as follows. *Gasterosteus aculeatus aculeatus*, a stickleback of fresh and brackish waters, lives mainly in the deep water of rivers marshes, inlets, and lagoons, and early in February migrates for reproduction to streams or paddy fields of freshwater plants where the water always flows slowly. Nest-building, spawning, and the male's care of the young fry take place in the freshwater between March and May, and early in June the adult fish returns to the former place, though this fry still remain in shoales until their migratory season early in September comes. But in the farther northern forms, as the nuptial season begins later, so the seasonal migration begins later also. In the males of *Gasterosteus*, vermilion-red color appears at first on the branchiostegal region.

Type locality: Lake Biwa.

Distribution: The present subspecies is distributed in very limited area of Gifu, Mie and Shiga Prefectures. In Gifu Prefecture, it is limited in Gifu City; Ôgaki City; Hyosa, Fuwa-gun; Imamura, Yasuhachi-gun; Kanô-machi, Inaba-gun; Uzura, Ihigun; Yawatamura, Ihigun; Tsuya, Yôrôgun; Takata mura, Yôrôgun; Aidomura, Motozugun; Kitakatamachi, Motosugun. In Mie Prefecture, it becomes nearly extinct. Lake Biwa (JORDAN et HUBBS); Southern region of Lake Biwa; Gifu; Ôgaki (KOBAYASHI); Gifu City; Ôgaki City; Hyosa, Fuwagun; Imamura, Yasuhachigun; Kanômachi, Inabagun; Uzwa, Ihigun; Yawatamura, Ihigun; Tsuya, Yorogun; Takatamura, Ihigun; Aitomura, Motosugun; Kitakatamachi, Motosugun, Gifu Prefecture; Nanatori, Kuwanagun, Mie Prefecture; southern coast, Lake Biwa, Shiga Prefecture; Uwaki, Monobemura, Kuritagun; Yasyû, Yasyûgun; Moriyamamachi, Yashûgun; River Inugami, Inugami gun; Toyogomura; Yatsushima, Yutamura, Higashiasaigun, Shiga Prefecture (IKEDA, K.), Mie Prefecture (OKADA); River Nagara; River Ibi, Gifu Prefecture; Nanatori, Kuwana-gun, Mie Prefecture; South, Coast, Lake Biwa (IKEDA).

Remarks: The difference between the present species and landrocked form of *Gasterosteus aculeatus aculeatus* is by the imperfectly developed lateral plate and peculiar coloration.

JORDAN and HUBBS remarked *Gasterosteus williamsoni japonicus* from Japan and they mentioned if the Japanese race should prove sufficiently distinct to be separated nomen-

* KOBAYASHI, 1932, Journ. Sci. Hiroshima Univ., ser. B, Div. 1, vol. 1, arb. 8, p. 150–151.

claturally it will, however, require a new name, as both HOUTTUYN and STEINDACHNER have used the combination *Gasterosteus japonicus*. There can be little doubt that these naked Sticklebacks of the rivers, however similar, have diverged independently from the marine form. As "ontogenetic species" they need not enter systematic lists.

Genus **Pungitius** COSTE, 1846.

Characters: Sticklebacks with 7 to 12 dorsal spines, directed more or less to the sides in a zigzag manner. A representative species of this genus will be found in the freshwaters of most north temperate of boreal regions, also entering the sea.

Key to Japanese species of Pungitius

a[1] Body nearly naked with few small lateral plates
  b[1] Caudal plates 8-9 on caudal peduncle; dorsal spines 7-12 in number; white transparent membrane on dorsal spines. Ventral spine long.................................**P. pungitius pungitius**
  b[2] Caudal plates 5-6 on caudal peduncle; dorsal spines 8-13 (10-11) in number; without white transparent membrane on dorsal spines. Ventral spine short.......... **P. pungitius tymensis**
a[2] Body with many small lateral plates on entire body..............................**P. pungitius sinensis**

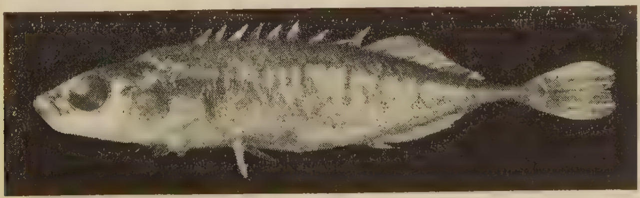
99. **Pungitius pungitius pungitius** (LINNE.).
"Ibara-tomiyo, Kitatomiyo, Ira-tomiyo"
(Text-fig. 104).

Gasterosteus pungitius LINNÈ, 1758, Syst. Nat., ed. x, p. 296. – NIKOLSKY, 1889, Mem. Acad. Sci. Petersburg, x, sup. no. 5, p. 292. – DAY, 1880–1884, Fish. Great Britain & Ireland, pp. 244-246, pl. LXVIII, fig. 4.

Gasteracanthus pungitius PALLAS, 1811, Zoogr. Rosso-Asit., iii, p. 228.

Pygosteus pungitius BERG, 1907, Proc. U. S. N. Mus., xxxii, p. 431. – JORDAN et EVERMANN, 1896, Fish. N. America, I, p. 745.-746. – JORDAN et GILBERT, 1899, Fish. Bering Sea, pp. 443-444. – EVERMANN et GOLDSBOROUGH, 1907, Fishes Alaska, p. 273. – JORDAN, TANAKA et SNYDER, 1913, Catal. Fish. Japan, p. 105. – BERG, 1916, Les Poissons des deaux douces de la Russie, p. 459. – TANAKA, 1921, Nihon Gyogaku, p. 238. – NICHOLS, 1943, Freshwater Fishes China, p. 236.

Pungitius pungitius, K. IKEDA, 1933, Zool. Mag., 45 (534), pp. 147-149, fig. 4, A-C. – MIYADI, 1935, Kyoto fuka Tansuigyo, p. 37, pl. 5, fig. 38. – OKADA et IKEDA, 1938, Sci. Rep. Tokyô Bun. Daig., sect. B, no. 55, p. 150. – OKADA et IKEDA, 1938, Saitô Hô-on Kai Mus., Resear. Bull., no. 15, pp. 110-111, pl. vi, fig. 4. – OKADA et NAKAMURA, 1948, Nihon no Tansuigyo, pp. 189-190, fig. 119. –



Text-fig. 104. ***Pungitius pungitius pungitius*** (LINNE). ×2
from Yusa-mura, Yamagata Prefecture.

AOYAGI, 1957; Gen. Notes Fresh. wat. Fish. Jap. Arch., pp. 183–184, figs. 156.
Gasterosteus pungitius brachypoda BEAN, 1882, Proc. U. S. N. Mus., iv, p. 240.
Pygosteus brevispinosus OTAKI, 1907, Trans. Sap. Nat. Hist. Soc., vol. 2, p. 87. – JORDAN, TANAKA et SNYDER, 1913, Catal. Fish. Japan, p. 106.
Pungitius brevispinosus JORDAN et HUBBS, 1922, Mem. Carn. Mus., vol. x, no. 2, p. 203. – KOBAYASHI, 1932, Journ. Sci. Hiroshima Univ., ser. B, Div. 1, vol. 1, art. 8, p. 148, pl. 1, fig. 3.

The original description is as follows:

Gasterosteus pungitius LINNAEUS*
145. *Gasterosteus Caput.*
Membr. branch. radius III. Arted.
Corpus ad caudam utrinque carinatum.
Aculei distincti ante pinam dorsi.
p. 269. *Pungitius* 5. G. spinis dorsalibus decem.
Art. gen. 52. syn. 80. spec. 97. Fn. svec. 277.
D. 10, 11. P.……… V. 1. A. 11. C.………
Habitat in Europa.

Description: Head 4; depth 5 in the length or $1\,^1/_2$ in head; snout 4 in head. Dorsal IX, 11, anal I, 11 (9). Body rather slender, naked, devoid of the lateral armature except those of 5 or 6 small ones forming a well-developed keel on the caudal peduncle. The ventral public plates lanceolate, the length shorter and width narrower; the *Parus scapularis* well-developed.

The ventral spine long and laterally serrated, with a weak soft ray following, its three times of the length equals the head length. The dorsal spines much longer than those

Table 105. a. Measurements of *Pungitius pungitius pungitius** (LINNE.).

Locality	Sex	Total length	Body length	B.L./B.H.	B.L./H.L.	Diameter of eye
Hokkaidô	♂	60mm.	52mm.	4.7	3.7	4.0mm.
(Akkeshi)	♀	70	60	4.6	3.5	4.0
(Fukagawa)	♂	58	50	5.0	3.3	4.0
	♀	60	52	5.2	3.5	4.0
(Sapporo)	♂	50	46	4.9	3.4	3.6
	♀	60	52	4.7	3.7	3.8
(Oonuma)	♂	56	49	5.0	3.4	4.0
	♀	62	54	5.2	3.7	3.6
Honshû	♂	51	43	4.8	3.3	3.8
(Aomori, Aisaka)	♀	63	54	5.4	3.8	1.0
(Yansagata, Tsuruoka)	♂	54	46	4.8	3.4	3.5
(Yamagata, Yusa)	♂	56	49	5.1	3.6	3.9
(Yamagata, Shinjo)	♂	52	44	4.4	3.1	4.1
(Yamagata, Otomi)	♀	60	52	4.6	3.6	4.0
	♂	45	38	4.2	3.2	3.7
(Niigata, Numatare)	♀	52	45	4.1	3.4	3.9
	♂	57	49	5.3	3.4	3.7
(Saitama, Kumagaya)	♀	63	55	5.2	3.0	3.8
	♂	41	35	4.1	3.5	3.1
(Tokyo, River Shakuii)	♂	38	35	5.0	3.5	3.5

* LINNAEUS, C. Systema Naturae 1758 Tomus I, p. 295.

Table 105. b. Measurements of *Pungitius pungitius pungitius** (LINNE.).

Length middle Dorsal spine	Length Ventral spine	H.L./V.S.	Length L.P.	L.L.P./B.L.P.
3.0mm.	5.0mm.	2.30	6.0mm.	2.0
3.0	6.0	2.60	8.0	2.0
2.6	4.4	3.41	6.3	2.1
3.1	5.1	2.94	6.8	2.2
2.7	4.4	3.09	6.2	2.4
2.8	5.2	2.71	6.8	3.0
2.7	4.6	3.15	6.5	3.2
2.9	2.8	3.02	7.5	2.3
2.5	4.0	3.25	6.5	2.2
3.0	5.0	2.80	8.0	2.2
2.6	4.8	2.79	6.1	2.2
2.8	4.6	2.89	6.7	2.3
2.3	4.0	3.52	5.4	2.0
2.8	5.0	2.90	6.6	2.0
1.9	3.6	3.27	4.3	2.2
2.0	3.7	3.54	5.1	2.2
2.9	7.5	3.18	6.2	2.1
3.2	5.0	2.98	6.7	2.0
1.9	3.7	2.70	3.7	1.4
2.0	4.0	2.30	5.0	2.5

* These specimens were measured by K. IKEDA in 1933.

Abrreviations:- B.L.—Body length, B.H.—Body height, H.L.—Head length, V.S.—Ventral spine, L.P.—Lateral plate, L.L.P.—Length of lateral plate, B.L.P.—Breadth of lateral plate.

Table 106. Measurements of *Pungitius pungitius pungitius* (LINNÉ).

Collection	O. H. B. S.*				
Total length	68.0mm.	64.0mm.	52.0mm.	60.0mm.	54.0mm.
Body length	60.0	55.5	45.0	53.0	47.0
Body length/Head	3.63	3.47	3.91	3.66	3.76
Body length/Depth	4.60	4.83	4.20	3.93	4.48
Body length/Predorsal length	3.26	3.08	3.00	3.26	3.14
Body length/Prepectoral length	3.18	3.05	3.38	3.47	3.36
Body length/Preventral length	2.70	2.58	2.62	2.87	2.67
Body length/Preanal length	1.54	1.58	1.55	1.61	1.61
Head/Snout	4.72	4.00	3.29	3.81	3.29
Head/Upper jaw	3.30	3.20	2.56	3.15	2.78
Head/Interorbital width	4.10	4.33	3.70	3.38	3.29
Head/Diameter of Eye	4.72	4.21	3.60	4.03	3.38
Head/Length of Caudal peduncle	2.36	2.23	1.39	1.75	1.47
Head/Depth of Caudal peduncle	8.25	8.80	7.67	8.05	8.33
Head/Length of Dorsal fin	1.10	1.19	1.08	1.09	1.04
Head/Length of Anal fin	1.18	1.37	1.15	1.23	1.13
Head/Height of Dorsal fin	2.46	2.46	1.90	2.30	2.02
Head/Height of Anal fin	2.20	2.20	2.06	2.42	2.15
Head/Peotoral length	1.74	1.69	1.69	1.98	1.74
Head/Ventral length	3.75	3.82	2.90	3.45	2.90
Date	9. IV. 1924				
Locality	Hokkaidô				

*Ôtsu Hydrobiological Station attached to Kyôto University.

of the other species. The bases of the dorsal and anal fins equal, and they are opposite each other.

The fresh color yellowish pale green and dusky above, the belly, chin, and ventral fins colorless. In the breeding season the males have the dusky or dusky black color on the body and fins.

Habits: The present species dwells in clear spring water and feeds on small aquatic animals. The breeding season is in spring. The males make a nest by weeds as *Hydrilla verticillata* CASP.

Type locality: Europe

Distribution: River Yana, River Kolyma, Sea of Okhotsk; Ajan, West coast of Kamchatka; Alaska; River Amur; Hokkaidô; Khatanga; Pechora; Archemgelsk; Lapland (BERG); Sakhalin, River Tym. Siska (NIKOLSKY); Aomori; Sapporo (JORDAN & HUBBS); River Fuka, Sapporo; Maruyama, Sapporo; Soen, Sapporo; Akkeshi; Ônuma; Hakodate; Hokkaidô; Aisaka, Kamikitagun, Aomori Prefecture; Aomori City Aomori Prefecture; Oomagari, Senhokugun, Akita Prefecture; Yusa, Hokaigun, Yamagata Prefecture; Kyotamura, Nishitagawagun, Yamagata Prefecture; River Seiryuji, Yamagata Prefecture; Shinjo, Mogamigun, Yamagata Prefecture; Tsuruoka City, Yamagata Prefecture; Aoki, Higashimurayamagun, Yamagata Prefecture; Otomimura, Kitamurayamagun, Yamagata Prefecture; River Shinano, Niigata Prefecture; Shibata, Niigata Prefecture; Osatogun, Saitama Prefecture; Kawagoe, Inumagun, Saitama Prefecture; Honjômachi, Kodamagun, Saitama Prefecture; Inokashira pond, Tôkyô; River Shakujii, Tôkyô (K. IKEDA). Siribeshi district, Sapporo; Asahigawa, Hokkaidô (KOBAYASHI); Lake Abashiri, Hokkaidô (OKADA & IKEDA); Huzisaka-mura, Kamikita-gun, Aomori Prefecture; Asamai-machi, Hirashika-gun, Akita Prefecture; Tsuruoka, Yamagata Prefecture (OKADA & IKEDA); Kyôto (MIYADI); Tanita-mura, Ôzato, Saitama Prefecture; Inokashira, Tôkyô; Shakujii, Tôkyô, River Shinano, Niigata Prefecture (IKEDA).

The southern limit of the present speceis is Kyôto.

Remarks: In the specimens preserved in Saitô Hô-on Kai Museum, Sendai, Miyagi Prefecture, IKEDA and the author found the variation of dorsal spine number ranging from 8 to 11.

Table 107. Variation of dorsal spine number

Localities of specimens	Number of dorsal spines			
	VIII	IX	X	XI
Aomori Prefecture	1	4	5	
Akita Prefecture		3	4	1
Yamagata Prefecture	9	11	4	

100. Pungitius pungitius tymensis (NIKOLSKY).
"Ezotomiyo, Ezoharisaba"
(PL. LI, figs. 1–14)

Gasterosteus tymensis NIKOLSKY, 1889, Mem. Acad. Sci. Petersburg, lx, p. 293.

Pygosteus undecimalis, JORDAN et STARKS, 1903, Proc. U. S. N. Mus., vol. xxvi, no. 1308, p. 62, fig. 1.

Pygosteus tymensis, BERG, 1907, Proc. U. S. N. Mus., xxxii, p. 425. – TANAKA, 1908, Annot. Zool. Jap., vol. vi, pt. 4, p. 239. – JORDAN, TANAKA et SNYDER, 1913, Catal. Fish. Japan, p. 105, fig. 79. – BERG, 1916, Les Poiss. des eaus douses de la Russie, pp. 460-461. – TANAKA, 1921, Nihongyogaku, p. 238.

Pungitius pungitius var. **tymensis** KOBAYASHI, 1932, Journ. Sc. Hiroshima Univ., Ser. B, vol. 1, art. 8, p. 149, pl. I, fig. 4.

Pungitius tymensis IKEDA, K. 1933, Zool. Mag., 45 (534), pp. 149 – OKADA et IKEDA, 1938, Sci. Rep. Tôkyô Bun. Daig., sect. B, no. 55, p. 150. – AOYAGI, 1957; Gen., Notes Fresh. Wat. Fish. Jap. Arch., pp. 184–185, fig. 157.

Description: Head $3\,^1/_5$ to $3\,^2/_5$ in length; depth 5 to $5\,^1/_2$. Dorsal VIII–XIII–10 or 11; anal I,–9 or 10.

The body somewhat slender, entirely devoid of body plates, except very small, 5 or 6 plates form a weak keel on short caudal peduncle.

Ventral spines very short and slender, equaling in length two-thirds to three-fourths diameter of eye. The dorsal spines, are many, 8–13 in numbers and very short subequal in length to next to last and are scarcely half diameter of eye in length. The last one is about a third higher and is equal in length to anal spine.

Table 108. Measurements of *Pungitius pungitius tymensis* (NIKOLSKY).

Collection	O. H. B. S.*				
Total length	84. 0mm.	83. 0mm.	57. 0mm.	61. 0mm.	49. 0mm.
Body length	75. 0	73. 0	50. 0	54. 0	42. 0
Body length/Head	4. 28	3. 90	3. 23	3. 72	3. 44
Body length/Depth	4. 47	4. 30	4. 75	4. 92	4. 67
Body length/Predorsal length	3. 26	3. 11	3. 00	2. 52	2. 80
Body length/Prepectoral length	3. 62	3. 44	3. 03	3. 48	3. 00
Body length/Preventral length	2. 77	2. 81	2. 56	2. 81	2. 62
Body length/Preanal length	1. 45	1. 47	1. 50	1. 49	1. 56
Head/Snout	3. 50	3. 40	3. 88	3. 82	3. 81
Head/Upper jaw	2. 78	2. 62	3. 88	3. 22	3. 05
Head/Interorbital width	3. 90	3. 78	3. 88	4. 04	3. 70
Head/Diameter of Eye	3. 90	4. 05	4. 70	4. 54	3. 82
Head/Length of Caudal peduncle	1. 85	1. 75	2. 14	1. 93	1. 94
Head/Depth of Caudal peduncle	7. 00	6. 67	7. 45	6. 60	6. 10
Head/Length of Dorsal fin	0. 97	1. 06	1. 30	1. 13	1. 02
Head/Length of Anal fin	1. 06	1. 11	1. 56	1. 26	1. 08
Head/Height of Dorsal fin	2. 57	2. 67	2. 64	2. 90	2. 44
Head/Height of Anal fin	2. 44	2. 34	2. 45	2. 42	2. 03
Head/Pectoral length	1. 79	1. 87	1. 75	1. 48	1. 87
Head/Ventral length	4. 61	4. 68	4. 05	3. 63	3. 70
Date	9, IV, 1924				
Locality	Hokkaidô				

* Ôtsu Hydrobiological Station attached to Kyôto University

Color dark greyish brown above, pale below; in young patched and striped with dark green.

Type locality: Sakhalin Island, Tymi River.

Distribution: Chitose, Hokkaidô (NOZAWA); Sakhalin (BERG); Lake Chipesani (TANAKA); clear stream near Sakaehama, Saghalien; Takigawa, Sapporo; Asahigawa (KOBAYASHI); Chitose, Hokkaidô (JORDAN & STARKS); Asahigawa; River Taki, Sapporo, Hokkaidô (KOBAYASHI);

Remarks: JORDAN and STARKS established a new species *Pygosteus undecimalis* from a specimen taken at Chitose, in Hokkaidô by Mr. NOZAWA. They stated the difference from *Pygosteus steindachneri* in having a more slender form, a slightly longer head, shorter and more slender ventral spines and particularly in having more numerous and shorter dorsa lspines. The mouth appears to be larger and the caudal peduncle to be thicker. The color is darker. After that time, many researchers agreed to identify *Pygosteus undecimalis* under the synonyme of *Pungitius tymensis* and took *Pygosteus steindachner* under the name of *Pungitius sinensis*.

Table 109. Measurements of *Pungitius pungitius tymensis** (NIKOLSKY).

Locality	Total length	Body length	B.L. / B.H.	B.L. / H.L.	Diameter eye
Hokkaidô	69mm.	58mm.	4.3	3.4	4.0mm.
(Ibarato)	71	60	4.5	3.5	4.0
(Sapporo)	53	48	4.8	3.2	3.7
	71	61	5.1	3.6	4.0
(Fukagawa)	50	43	4.7	3.2	3.4
	54	47	4.7	3.6	3.5
(Omura)	51	44	4.6	3.3	3.6
	56	50	4.7	3.5	3.7

Length middle Dorsal spine	Length Ventral spine	H.L. / V.S.	Length L. P.	L.L.P. / B.L.P.
1.8mm.	3.0mm.	5.83	5.0mm.	2.0
1.9	3.0	5.67	6.3	2.5
1.1	2.9	4.83	3.3	1.8
1.8	3.7	4.57	6.4	2.6
1.2	2.5	5.40	3.5	1.8
1.3	3.2	4.06	3.9	2.3
1.3	2.8	4.78	3.8	2.0
1.9	3.4	4.23	5.2	2.5

* These specimens were measured by K. IKEDA in 1933.

Abbreviations:- B.L.—Body length, B.H.—Body height, H.L.—Head length, V.S.—Ventral spinle L.P.—Lateral plate, L.L.P.—Length of lateral plate, B.L.P.—Breadth of lateral plate.

In 1956, ICHIKAWA and others published an illustration of development of *Pungitius pungitius tymensis* (NIKOLSKY).

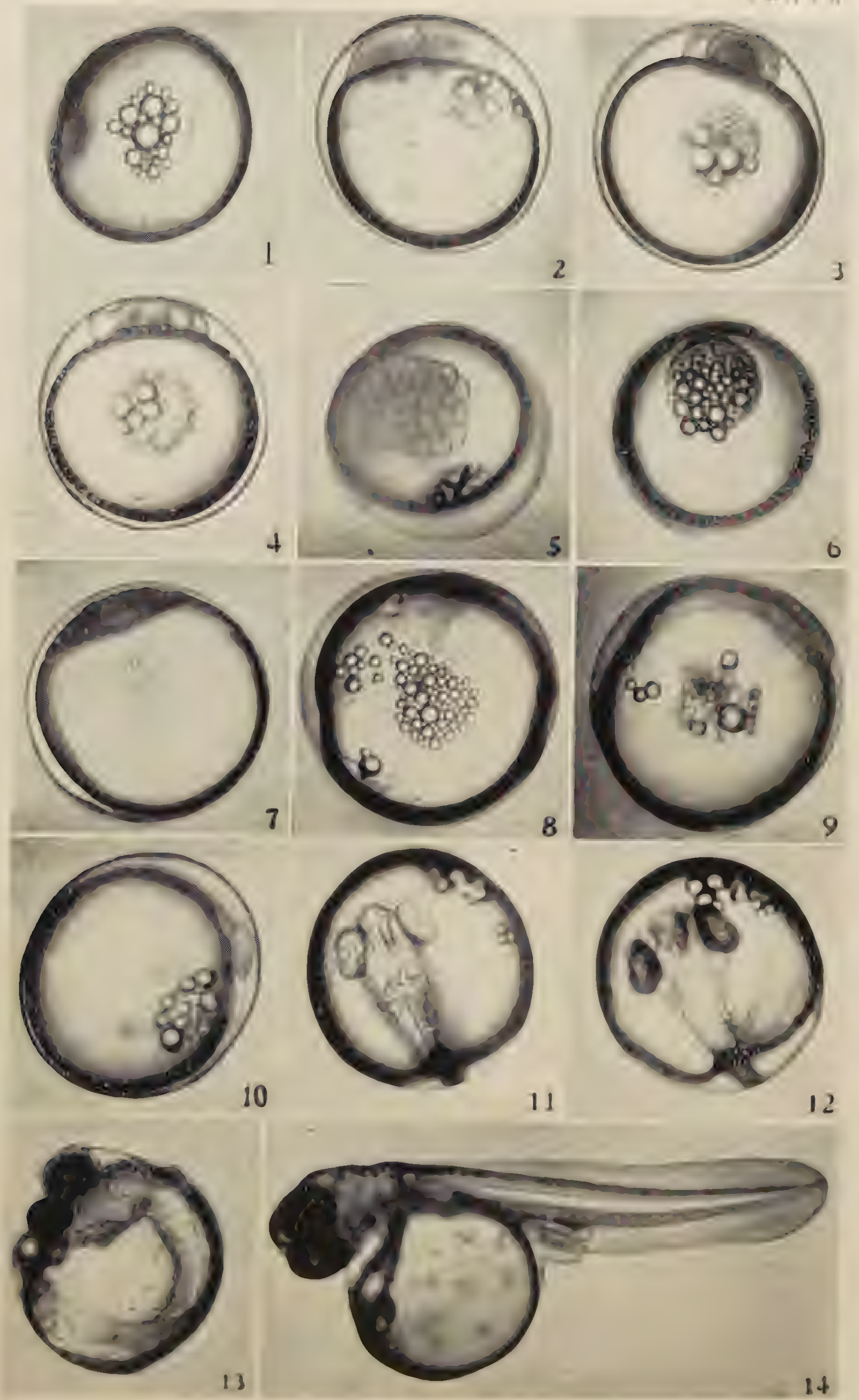
They made the artificial fertilization under the water temperature of 15–18°C during the end of March and end of May at Sapporo, Hokkaidô. The egg is cubical, measured

PLATE LI

Development of ***Pungitius pungitius tymensis***, after Sumihiko, Ichikawa (1956).

1. Unfertilized egg.
2. 2 cell stage, 2° after fertilization.
3. 4 cell stage, 3°50′ after fertilization.
4. 12 cell stage, 5°50′ after fertilization.
5. 32 cell stage, 7° after fertilization.
6. Morula stage, 7°50′ after fertilization.
7. Brastula stage, 15° after fertilization.
8. Gastrula stage, 33° after fertilization.
9. Early embryonal stage, 43° after fertilization.
10. Advanced stage of embryo, 69° after fertilization.
11. Embryo with optic vesicle, 93° after fertilization.
12. Embryo with pectoral fin, 153° after fertilization.
13. Embryo just before hatching out, 203° after fertilization.
14. Larva just hatched out, 212° after fertilization.

PLATE II



1.2 mm. in diameter, with light yellow yolk and oil globules. They show the nomenclature of the development of the egg as follows.

Table 110. Stages of cell-segmentation and organ formation, under water temperature 12°.

Developmental stage	Time after fertilization	Development stage	Time after fertilization
Formation of fertilization membrane	20′	Early embryonal stage	48°
One cell stage	90′	Optic lobe formation	57°
Two cell stage	2°40′	Optic lobe formation	93°
Four cell stage	3°50′	Optic cup formation	103°
Eight cell stage	4°50′	Melanophore formation	142°
16 cell stage	5°50′	Heart pulsation	151°
32 cell stage	7°	Pectoral fin formation	153°
Morula stage	7°50′	Blood vessel formation	157°
Brastula stage	11°	Movement of embryo	189°
Post brastula stage	15°	Embryo just before hatching	203°
Mid-gastlura stage	33°	Embryo just after hatching	212°

101. **Pungitius pungitius sineinsis** (GUICHENOT).

Needle-mackerel "Tomiyo, Harisaba"

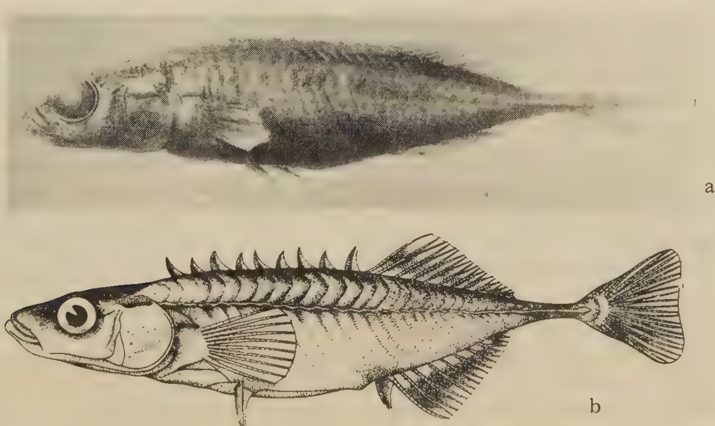
(Text-figs. 105, a–b)

Gasterosteus sinensis GUICHENOT, 1869, Nouv. Arch. Mus. Hist. Nat. Paris, v, p. 204, pl. xii, fig. 4.

Gasterosteus japonicus STEINDANCHNER, 1880, Sitzber. Aca. Wien, Mat.-Nat. pl. Lxxxii, p. 264, pl. iii, fig. 2. – JORDAN et SNYDER, 1901, Annot. Zool. Not *Gasterosteus japonicus* HOUTTUYN = *Monocenters japonicus* (HOUTTUYN).

Gasterosteus bussei WARPACHOWSKI, 1887, Trud. Soc. Natur. Petersburg, xix, pp. 13, 54, fig. 1.

Pygosteus steindachneri JORDAN et SNYDER, 1901, Proc. U. S. N. Mus., xxvii, p. 747.



Text-fig. 105. a. ***Pungitius sinensis*** (GUICHENOT). ×1
b. ***Pungitius sinensis*** (GUICHENOT). ×1

Pygosteus sinensis TANAKA, 1921, Nihon Gyogaku, p. 239. - CHU, 1931, Biol. Bull. St. John's Univ., Shanghai, no. 1, p. 97.

Pygosteus pungitius sinensis NICHOLS, 1943, Freshwater Fishes China, p. 236.

Gasterosteus pungitius ISHIKAWA, 1897, Prel. Cat., p. 59.

Gasterosteus sp. ISHIKAWA, 1897, Prel. Cat., p. 59.

Pygosteus sinensis FEPPU, 1909, P. 61561, AMYPA, CTP. 191. - JORDAN et STARKS, 1905, Proc. U. S. N. Mus., xxviii, p. 203.

Pungitius sinensis JORDAN et HUBBS, 1925, Mem. Carn. Mus., x, no. 2, p. 202. - KOBAYASHI, 1932, Jour. Sc. Hiroshima Univ. Ser., B, vol. 1, art. 8, pl. i, fig. 5. - OKADA et IKEDA, 1938, Sci. Rep. Tokyô Bun. Daig., sect. B, no. 55, p. 150. - OKADA et IKEDA, 1938, Saitô Hô-on Kai Mus. Research Bull., no. 15, pp. 111-112, pl. vi, fig. 5. - AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 185-187, fig. 158.

Pygosteus sinensis wossnessenskyi KESSLER, 1876, Prewalski, Mongolia, and the land of Tanguts, p. 9.

Pygosteus kaibarae TANAKA, 1915, Zool. Mag., 27(325), p. 565. - TANAKA, 1920, Fishes of Japan, pp. 489-491, pl. 134, fig. 376. - TANAKA, 1921, Nihon Gyogaku, p. 239.

Pungitius sinensis var. kaibarae KOBAYASHI, 1932, Journ. Sci. Hiroshima Univ., Ser. B, vol. 1, art. 8, pl. I, fig. 6.

The original description * is as follows:

Cet Épinoche ou Gastérosté, que nous n'avons pu rapporter à aucun de ceux déjà décrits jusqu à presént, appartient à la division des espèces a épines dorsales nombrueses. Nous l'indiquons sous une nouvelle dénomination spécifique, celle de *sinensis*, du nom du pays oú il a été observé pour la première fois, et oú il genre n'est encore représenté, à notre connaissance, que par l'espèce actuelle, autour de laquelle viendront trés certainement s'en grouper d'autres de la même mer, et aussi des autres mers de l'Inde. Le Gastérosté de Chine a une forme générale qui est celle de plusieurs autres espèces de son genre, à corps comprimé et allongé en fuseau. Ill se fait, en outre, remarquer par une série de petites lames osseuses, étroites, allongèes, et placées sur tout le trajet de la ligne latérale. La tête de ce poisson est mince, effilèe et projetée en avant; le dessus en est à peu pres plane, et le museau un peu concave en avant des yeux. Ces organes sont grands, à proportion des diamensions du poisson que nous examinons. Les sousorbitaires, au nombre de trois, sont grands et couvrent en grande partie la joue. L'appareil operculaire est également grand; son ensemble representé une piece presque triangulaire. Les mâchoires sont garnies d'une bande de dents fortes, crochues, et allant en dècroissant de devant en arrière. Les individus du Gastérosté que nous décrivons ne nous permettent pas de compter les rayons mous de leurs mageovies, tant ils sont petits. Les épines dorsales sont grêles et munies chacune à leur base postérieure d'une petite membrane, comme à l'ordinaire; elles sont au nombre de sept. Ces épines sontl egérèment arquees et sans dentelures apparentes à leur bord postèrieur. Le bassin forme une plaque triangulaire, terminée en arrière par une pointe aigue, et où s'attachent en avant les épines ventrales, qui sont droites, assez longues et lisses à leus bord. L'anale est une nageoire assex étendue, de moitie plus longue que haute, et de forme oblique, comme l'est, du reste, la dorsale molle, et comme c'est l'ordinaire dans les autres espèces de ce genre; elle est armée en avant d'une épine longue, un peu arquée et lisse. Les pectorales sont aiues et plus longue que larges. La queue, derrière la seconde dorsale et l'anale, est garnie sur les côtes d'une carène tranchante; la nageoire que la termine, la caudale, a son bord postérieur coupé carrément.

Le corps de cette espèce est d'un brun argenté en dessus, plus pâle ou moins foncé en dessous, et marqué d'une quantité de très petits points noirs irreguliers, amsi que les nageoires, qui nónt aucune ceuleur particulière; elles sont claires. L' oppercule et l'épaule brillent d'un bel éclat d'argent.

Les échantillons que nous avons du Gastérostée que nous décrivons proviennent de Chine, et le Muséum les doit à M. l'abbé Armand David. Ills ne dépassent pas, les plus grands, 26 millimètres en longueur.

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* GUICHENOT, 1869, Nouv. Arch. Mus. Hist. Nat. Paris, v, p. 204-206.

Description: D. VIII–X–9–10; A. I, 10; P. 10; V. I, 2.

Body long, fusiform, compressed, without true scales; 20 plates along middle of body behind shoulder spine; of these anterior 7 are large and vertical; the rest being very small; caudal peduncle greatly flattened. Head large, pointed; eye moderately large, lateral, high up; snout moderately long, pointed; nostril tubular, in a depression in front of eye. Detached spines of dorsal subequal to last but one, slender, pointed, last one a little longer; anal spine equal in length to last spine of dorsal; pectoral low down, with broadly rounded posterior margin, far in front of vent; ventral abdominal, spine $1\,^1/_4$ times eye diameter, but not reaching to vent; caudal subtruncate when spread.

Color in fresh, greyish green with irregular stripes and bands of dark greyish green, pale below; in males, the base of dorsal and anal fins dusky.

Type locality: China, Yang-tse-Kiang.

Distribution: Hakodate, Hokkaidô (BERG); Gensan, Korea (JORDAN & STARKS); Gulf of Strielok near Vladivostok (STEINDACHNER); Lefu River, tributary of Khanka Leke, basin of Amur (WARPACHOWSKI); Inokashira, Musashi; Yamashiro (JORDAN, STARKS); Clear streams western regions of Ou to Hokuriku; Kisshoji, Tôkyô, Chikazono and Kaneda, Tochigi Prefecture (KOBAYASHI); Western coast of Kamtchatka (KESSLER); Abashiri Lake, Hokkaido (OKADA et IKEDA); Inokashira, Tokyô; Aomori; Yamashiro (JORDAN & STARKS); Sapporo; Reibunto, Hokkaidô; Nanao, Ishikawa Prefecture (OTAKI): Chikazono, Kaneda, Nasu district, Tochigi Prefecture (KOBAYASHI); Kyôto; Kaibara, Hyôgo Prefecture (KOBAYASHI); Kyôto; Kashihara, Hyôgo Prefecture (TANAKA); Asamai-machi, Hirashika-gun, Akita Prefecture; Hachirogata, Minami Akita-gun, Akita Prefecture (OKADA & IKEDA); Reibun Island, Hokkaidô; Hakodate, Hokkaidô; Akkeshi, Hokkaidô; Nokkeushi, Hokkaidô; Yukihata mura, Higashitsugarugun, Aomori Prefecture; Jusaburo gata, Aomori Prefecture; Hachirogata, Akita Prefecture; Hanadate, Akita Prefecture; River Yamaberi, Iwafunegun, Niigata Prefecture; Ikiji, Shimoshinkawagun, Toyama Prefecture; Toyama City, Toyama Prefecture; Oshimizu, Kitahanuyamura, Toyama Prefecture; Sainen, Ishikawagun, Ishikawa Prefecture; Noda, Okuwamura, Ishikawa Prefecture; River Katsura, Kyôtofu; Nishishichizyo, Kyôto City; Kyogaku, Kuzunogun, Kyôtofu; Kawaokamura, Kyôtofu; Kuze, Kyôtofu; Kichizyoin, Kiigun, Kyôtofu; Kamitobamura, Kyôtofu; Kako River, Hyôgo Prefecture; Kashihara, Hikamugun, Kyôtofu; Shimizu, Narumatsu machi, Kyôtofu; Wadamura, Kyôtofu (K. IKEDA); Yokohama (JORDAN & SNYDER); Kichishoin, Southwest of Kyôto (TANAKA); Southwestern corner of Kyôto; Nishihichijô, Kyôto; East of Karahashi, Kyôto; West and South of Karahashi, Kyôto; Kisshoin, Kyôto; West of Kyogoku, West of Katsura, Kyôto; South of Kawaoka, South of Kuze, Kyôto; Hikami, Hyôgo Prefecture; South west and north west Kaibara, Kyôto (KOBAYASHI); River Kako, Hyôgo Prefecture (TANAKA); Aomori Prefecture – Ishikawa Prefecture (IKEDA).

The southern limit of geographical distribution of the present species is Kako-Gawa, Hyôgo Prefecture.

Remarks: IKEDA and the author[1)] examined ten specimens from Lake Abashiri, Hokkaidô in 1938. The specimens are measured; Total length 55.6 mm–50.7 mm; length exclusive of caudal fin 49.6 mm–45.1 mm. Deepest depth 5.4–5 in length; head 3.5 to 3.3. Dorsal spine 10–9. Length of the ventral spine longest, 7.1–6.9 in length.

KOBAYASHI[2)] stated the local variations found in many specimens from the southern region of Niigata Prefecture to Ishikawa Prefecture have two ventral fin rays, while many specimens from the northern region of Niigata Prefecture to Aomori Prefecture have one ventral fin ray, and some of those specimens have one ventral fin ray on one side and two ventral fin rays on other side. IKEDA[3)] also stated that in the Japanese specimens, the number of the dorsal spines vary from 6 to 10. He and the author[4)] mentioned the variation numbers of dorsal spines from the following specimens.

Number of dorsal spines	VIII.	IX.	X.
Number of specimens	5	27	3

KOBAYASHI, J. (1933)[5)] published a paper on the ecology of *Pungitius sinensis* var. *kaibarae* (TANAKA), lived in the south-western outskirts of Kyôto during November 1925 and February, 1927. He stated that the present species migrated for quite a distance between the breeding grounds and the deep water of the streams far away. Except the females with the matured ova and larvae less than about 3 cm. long, this fish fights his rivals by means of a peculiar method; he holds himself ready to strike at these rivals, raising all his spines, and bending his body in an S-shaped form or reverse. S-shaped form opposite the latter, and then attacks them with his mouth and ventral spines; but besides the struggling of the males in the spawning period, their warface is not so desperate nor so persistent. His fighting qualities begin to appear when he reaches about 2.4 cm. long. On the spawning period arriving, the male color gradually assumes a dark bluish black unless the female color does not change.

The spawning season occurred during the last decade of January and that of June. For the preparation of the nest-building, the male first obtains a disirable sheltered place in the shadows of aquatic plants and clear it, and then he makes a foundation with bits of soft material, in form like a small basket laid on its side and having two pores, one in front and one in back. On the foundation being ready, the male attaches the bits of soft material on the inside and outside and strokes these with his ventral side, bending his body crescent shaped, and secreting the mucous, and so on until the nest is completed. The complete nest is an nearly spherical hollow about 3.5 cm. in diameter, and has one frontal pore; but the back wall, where the other pore was, is thin and usually has some crevices.

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1). OKADA et IKEDA, 1938, p. 150.
2). KOBAYASHI, 1932, p. 149.
3). IKEDA, 1933, pp. 135–157.
4). OKADA et IKEDA, 1938, p. 111.
5). KOBAYASHI, 1933 Jour. Sci. Hiroshima Univ. ser. B, Div. 1, vol.. 2, art. 5.

Table 111. Measurements of *Pungitius pungitius sinensis** (GUICHENOT).

Locality	Sex	Total length	Body length	B.L./B.H.	B.L./H.L.	Diameter of eye
Hokkaidô (Nokkeushi)	?	56mm.	49mm.	4.9	3.7	3.6mm.
Honshu	♂	52	45	4.1	3.4	3.9
(Akita, Hanatate)	♀	52	40	4.7	3.2	3.7
(Niigata, Murakami)	?	56	44	4.6	3.1	3.8
(Ishikawa, Kanazawa)	?	56	49	4.1	3.5	3.9
(Kyôto)	♂	46	40	4.4	3.2	3.1
	♀	45	40	4.3	3.3	3.5

Length middle Dorsal spine	Length Ventral spine	H.L./V.S.	Length L.P.	L.L.P./B.L.P.
3.0mm.	5.0mm.	2.60	6.0mm.	2.4
2.6	4.4	3.00	6.1	2.4
2.7	4.6	2.74	6.0	2.3
3.4	5.2	2.67	7.0	2.7
2.0	4.4	3.22	7.1	1.7
2.2	4.7	2.41	6.0	3.0
2.3	4.9	2.51	6.0	2.7

* These specimens were measured by K. IKEDA in 1933.

Abbreviations:- B.L.—Body length, B.H.—Body height H.L.—Head length, V.S.—Ventral spine, L.P.—Lateral plate, L.L.P.—Length of lateral plate, B.L.P.—Breadth of lateral plate.

When the male, having completed his nest, seeks his mate, he draws near her, raising all his spines, fully spreading his dorsal and anal fins, and oscillating his caudal fin swiftly; and then he swims around to induce her, propelled by his pectoral fins, assuming a darker color, and bending his body in an S-shaped form or reverse S-shaped form opposite to her; but he never obliges her to lay her ova by attacking her.

No sooner has the female taken her departure, by breaking out though the back wall, than the male immediately enters, deposits his milt on the eggs, which he does not usually introduce any more. The male seems to introduce from 3 to 10 females into the nest during a few days, and after that he does not usually introduce any more. During

Table 112. Measurements of *Pungitius pungitius sinensis* (GUICHENOT)

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total length	62.0mm.	Head/Interorbital width	4.00
Body length	54.0	Head/Diameter of Eye	3.68
Body length/Head	3.86	Head/Length of Caudal peduncle	1.56
Body length/Depth	5.40	Head/Depth of Caudal peduncle	9.33
Body length/Predorsal length	1.69	Head/Length of Dorsal fin	1.00
Body length/Prepectoral length	3.27	Head/Length of Anal fin	1.04
Body length/Preventral length	2.70	Head/Height of Dorsal fin	2.59
Body length/Preanal length	1.57	Head/Height of Anal fin	2.41
Head/Snout	3.50	Head/Pectoral length	2.00
Head/Upper jaw	4.37	Head/Ventral length	2.46
Date	VI, 1938		
Locality	Akita City, Akita Prefecture		

* Ôtsu Hydrobiological Station attached to Kyôto Universety.

the male protects his nest either with eggs or without, there is often a struggle in which he keeps himself and the nest hidden with a cloud of mud stirred up from the muddy bottom with his pectoral, anal, and caudal fins, and then attacks the invader suddenly. All the eggs in the nest are glued together in one or two masses, but all of them hatch out at the same time, about 9 or 10 days after the egg-laying. The newly hatched out larva comes out of the nest after 10 days after hatching, and begins to swim around in shoals, leaving the male care, about 3 days or more. After that, the male, having finished his protection of the eggs and youngs conceal themselves in the sheltered part of aquatic plants, grow slowly and at least die. Many of the females die after two egg-layings at intervals of about 50 days, but some of them die after three times.

Order Percida

Characters: Bony fishes, mostly have two dorsal fins united or not united basally. Ventrals have not more than 6 rays and usually, although not always, thoracic. No weberian apparatus. Mouth edge formed by premaxillary normally distinct, always present. Shoulder girdle connected by post-temporal with skull. Hypercoracoid and hypocoracoid distinct, ossified former usually perforate. No mesocoracoid or inter-clavicles. Pharyngeals well developed, lower rarely united, third upper largest, fourth often absent. Opercular apparatus complete. Front vertebrae unmodified, without ossicula auditus. Gill opening before pectorals. Gill laminated. Air vessel typically without duct in adult. Scales variable, typically cgenoid. Lateral line usually extends high.

The majority of living fishes are included in this group.

Suborder Mugilina

Characters: Elongate body with small to large scales. Two dorsal fins, first of a few spines. Caudal forked to emarginate.

Family Mugilidae

Characters: Body oblong, more or less compressed, covered with rather large cycloid scales; no lateral line, but the furrows often deepened on the middle of each scale so as to form lateral streaks. Mouth small, the jaws with small teeth, or none, the teeth various in form; premaxillaries protractile. Gill openings wide, the membranes separate, free from the isthmus. Branchiostegals 5 or 6. Gill rakers long and slender. Gills 4, a slit behind fourth. Pseudobranchiae large. Two short dorsal fins, well separated, the anterior with 4 stiff spines, the last one of which is much shorter than the others, second dorsal longer than the first, similar to anal; anal spines 2 or 3, graduated; ventral fins abdominal, not far back, composed of 1 spine and 5 rays; caudal forked. Air bladder large, simple. Intestinal canal long. Peritoneum usually black. Vertebrae 24.

Genus Mugil (Artedi) Linnaeus, 1758.

Mugil (Artedi) Linnaeus, Syst. Nat., Ed. X, 1758, 316, (*cephalus*).
Type............**Mugil cephalus.**

Characters: Body oblong, somewhat compressed, covered with large scales. Head large, convex, scaled above and on sides. Mouth small, subinferior, the lower jaw angulated. Jaws with one or a few series of short, flexible, ciliform teeth; no teeth on vomer or palatines. Eye large, with a large adipose eyelid, which is little developed in the young. Stomach muscular, like the gizzard of a fowl. Species very numerous, living on mud and running in great schools along the shores and in brackish lagoons of all warm regions.

102. Mugil cephalus LINNAEUS.

Common mullet, Striped mullet, Macho, Cefals, Machoto, "Bora"
(Text-figs. 106, a–b)

Mugil cephalus LINNAEUS, 1758, Syst. Nat. ed. 10 a, p. 316. – GÜNTHER, 1861, Cat. Fish., III, p. 417. – HAMILTON, BOUCHANAN, 1822, Gangetic Fish, p. 119. – JORDAN et SWAIN, 1884, Proc. U. S. Nat. Mus., p. 263. – EVERMANN et JENKINS, 1892, Proc. U. S. Nat. Mus., pp. 16–136. – JORDAN et EVERMANN, 1896, Fish North and Middle America, I, pp. 811–812. – FOWLER, 1903, Proc. Acad. Nat. Sci., 55, p. 743. – JENKINS, 1904, Bull. U. S. Fish. Comm., 22, p. 438. – JORDAN et EVERMANN, 1905, Bull. U. S. Fish. Comm., XXIII, pt. 1, p. 139, fig. 48. – JORDAN et SEALE, 1905, Proc. U. S. Nat. Mus., 29, p. 521. – JORDAN et RICHARDSON, 1907, Bull. U. S. Bur. Fish., 27, p. 244. – TANAKA, 1911, Fishes of Japan, 3, pp. 50–53, pl. XIII, figs. 42–45. – JORDAN et MOTZ, 1913, Mem. Carn. Mus., vol. VI, no. 1, p. 26. – FOWLER, 1915, Proc. Acad. Nat. Sci., 67, p. 248. – MCCULLOCH, 1919, Check-list of Fishes of N. S. Wales, 2, p. 38. – TANAKA, 1921, Nihon Gyogaku, p. 343, fig. 103. – WEBER et De BEAUFORT, 1922, Fish. Indo-Austr. Arch., 4, p. 254. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. X, no. 2, pp. 207–208. – FOWLER, 1928, Mem. B. P. Mus., 10, p. 125. – UI, 1932, Kisyû Gyofu, p. 79. – ROXAS, 1934, Phil. Journ. Sci., vol. 54, no. 3, pp. 407-408· – OKADA, MATSUBARA UCHIDA, 1935, Nihon Gyorui Zusetsu, p. 102, pl. 40, fig. 3. – OKADA et IKEDA, 1938, Saitô Hô-on Kai Mus., Research Bull., no. 15, p. 112. – OKADA et NAKAMURA, 1948, Nihon no Tansuigyorui, p. 191, fig. 121. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fist. Jap. Arch., pp. 189-190, fig. 160.

Mugil our FORSKAL, 1775, Descr. anim, p. 44. – RÜPPELL, 1835-1840, Neue. Wirbelthiere, p. 131. – JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., 23, p. 744.

Mugil cephalotus CUVIER et VALENCIENNES, 1836, Hist. Nat. d. Poissons 11, p. 110. EYDOUX et SOULEYET, 1841, Voy. de la "Bonite", p. 175. – BLEEKER, 1858-59, Nat. Tijdschr. Ned. Ind., 16, p. 277. – BLEEKER, 1860, Act. Soc. Sc. Indo. Neerl., VIII, p. 51. – KNER, 1865, Novara-Exp. Fische I, p. 224. – GÜNTHER 1867, Ann. Mag. Nat. Hist., 20, p. 64. – BLEEKER, 1873, Ned. Tijdschr. Dierk., 4, p. 100, 143. – BLEEKER, 1875, Poissons de Madagascar, p. 45. – BLEEKER, 1879, Verh. Akad. Amsterdam, 18, p. 2. – GÜNTHER, 1880, "Challenger" Report, 6, p. 33. – NYSTROM, 1887, Bihang K. Sv. Vet. Akad. Handl. 8, Ajd. 4, No. 4, p. 38. – SAUVAGE, 1891, Poiss. Madagascar, p. 402.

Mugil japonicus TEMMINCK et SCHLEGEL, 1854, Fauna japonica, Poiss., p. 134, pl. LXII, fig. 1. – BLEEKER, 1853, Verh. Bat. Gen. 25, p. 41. – BLEEKER, 1873, Ned. Tijdschr. Dierk 5, p. 143. – BLEEKER, 1879, Verh. Akad. Amsterdam 18, p. 17.

Mugil macrolepidotus RICHARDSON, 1846, Ichth. Seas of China and Japan, p. 249.

Mugil dobula GUNTHER, 1859-61, Cat. Brit. Mus., 3, p. 420. – GÜNTHER, 1876-81, Fische d. Südsee, 2, p. 214. – STEINDACHNER, 1900, Denkschr. Akad. Wien 70, p. 501.

Mugil oeur KLUNZINGER, 1870, Abhandl. zool-bot. Ges. Wien 20, p. 829. – DAY, 1878-1888, Fishes of India, 4°, p. 353. – KLUNZINGER, 1884, Fische d. Rothen Meeres, p. 132. – STEINDACHNER et DOFLEIN, 1887, Fische Japans 4, Denkschr. Akad. Wien 53, p. 266. – DAY, 1889, Fauna of British India 2, p. 348. – RUTTER, 1897, Proc. Acad. Nat. Sci. Phila., p. 70. – JORDAN et SNYDER, 1901, Annot. Zool. Jap., vol. III pt. 2, 3, p. 62. – JORDAN et EVERMANN, 1902, Proc. U. S. Nat. Mus., 25, p. 332.

– SENO, KANEGAE et HIGASHI, 1908, Nihon Gyokai Zusetsu, pp. 52–53, fig. – TANAKA, 1921, Nihon Gyogaku, p. 343.

Mugil hypselosonia OGILBY, 1897, Proc. Linn. Soc. U. S. Wales 22, p. 74.
Mugil albula LINNAEUS, 1766, Syst. Nat. Ed., 12, p. 520.
Mugil tang, BLOCH, 1794, Ichthyologia, plate, p. 395.
Mugil plumieri, BLOCH, 1794, Ichthyologia, plate, p. 396.
Mugil lineatus, MITCHILL, Ms., CUVIER et VALENCIENNES, 1836, Hist. Nat. Poiss., XI, 96.
Mugil rammelsbergii, TSCHUDI, 1845, Fauna Peruaua, Ichthy., 20.
Mugil berlandieri, GIRARD, 1859, U. S. & Mex. Bound. Surv., 20, plate 10, figs. 1–4.
Mugil guntheri GILL, 1863, Proc. Ac. Nat. Sci. Phila., 169.
Mugil mexicanus STEINDACHNER, 1875, Ichthyol. Beiträge, III, 59.
Mugil albula, JORDAN & GILBERT, 1883, Synopsis, 403.



Text-figs. 106. a. ***Mugil cephalus*** LINN. × ⅓
b. ***Mugil cephalus*** LINN. × ½

The original description* is as follows:

Mugil*. *Caput: Labia* membranacea:
inferius introrsum carinatum. *Dentes* nulli. Denticulus inflexus supra sinus oris.
Membr. branch. radiis vii curvis;
Opercula laevia rotundata.
Corpus albicans.

Cephalus. 1. Mugil D. 4, $^{1}/_{9}$. P. 16. V. $^{1}/_{6}$. A $^{3}/_{12}$. C. 12.
Art. gen. 32. syn. 52. spec. 71. Mugil.
D. 5. $^{1}/_{11}$. P. 18. V. $^{1}/_{6}$. A. $^{3}/_{13}$. C............
Hasselqv. iter. 385. Mugil
Cephalus D. 5, $^{1}/_{11}$. P. 18. V. $^{1}/_{6}$. A. $^{3}/_{13}$. C............
Habitat in Oceano Europaeo. *fluvios subiens.*
Betargo italorum ex hujus ovis.

* LINNAEUS C., Systema Naturae, 1758, Tomus I, p. 316.

Description: Head $4\,^1/_6$; depth $3\,^5/_6$, D. IV–1,8; A. III, 8; P. 17; V. 1. 5; C. 14; scales counted to root of caudal in a longitudinal series 38; in a transverse series 15 or 16. Body rather elongate, somewhat compressed, its depth, moderate. Head short, broad, slightly depressed, upper profile nearly straight, but lower strongly curved. Snout rather narrow and acutish; its upper profile little less oblique than lower. Interorbital space slightly convex, $2\,^2/_5$ in head. Upper lip rather thin. Space at the chin between mandibulany bones oblanceolate, acutish posteriorly. Preorbital narrow, not nearly convering the maxillary. Eyes anterior, high up, with broad adipose eyelids, and eyelids convering eye posteriorly more than anteriorly. Teeth closeset, rather small, but evident. Gill openings wide, membranes separate, free from isthmus; branchiostegals 5 or 6; pseudobranchiae welldeveloped; gill-rakers on first gill arch $59+85$.

Scales rather small; about 23 large scales between origin of dorsal and tip of snout; scales on top of head slightly enlarge; soft dorsal and anal with very few scales.

First dorsal inserted slightly nearer tip of snout than root of caudal; first spine longest, all spines graduated in length; second dorsal inserted slightly nearer root of caudal than origin of first dorsal. Marging soft dorsal concave, seventh ray shotest, $2\,^1/_2$ times in length of second of longest ray; anal little larger in size than, but similar in form to second dorsal. Pectoral reaching nearly to front of spinous dorsal, its insertion above axis of body. Caudal deeply forked.

Color dark bluish above; sides silvery; with conspicuous dark stripes along each row of scales; pale yellowish below; ventrals yellowish, other fins somewhat dusky.

Habits: The present species in widely distributed around the world, in both tropical and temperate zones, along the coasts of the Pacific, Atlantic and Indian Oceans and the Miditerranean Sea. It occurs on the entire coast of Korea and north to Hokkaidô of Japan. Although not an anadromous fish in the strict sense, it occurs in fresh as well as salt water. It moves down to the deeper bottom of the sea far spawning, probably in autumn and winter. The fishes, when 30 to 60 mm. long, migrate from the open sea into the brackish water of estuaries and lowland lakes, where they grow to a length of 250 mm. by October of the first year, before returning to the sea. The young of about 100 mm. are commonly found in the tide-pools on the rocky shore of Bôshû, Chiba Prefecture. The feeding habits of this fish are peculiar, as they eat diatoms and green algae along with the mud in which these organisms are contained. As an adaptation to such food, the stomach walls are very thick, as in the gizzard of a bird; the thick, muscular stomach of the mullet is called the "Sorobandama" (abacus ball), or the navel or the mortar of the mullet. This fish is noted for its habit of leaping out of the water. On account of its rapid growth and its ability to live in fresh and brackish water the striped mullet is very commonly cultivated.

The young fishes, caught when ascending into the rivers and lakes in the spring time, are raised in fish ponds near the coast. They are usually kept in ponds with carp or eel, since the difference in the feeding habits of these species makes it possible to efficiently raise them together. In the Chugoku district of Honsyû, the mullet is raised in

the flat ponds in which salt has been evaporated; flour or powered silk-worm pupae are used as food.

Remarks: This mullet bears varied names, depending largely on size: "Oboko", "Inako" or Subashiri when 30 to 180 mm. long; "Ina" when 180 to 300 mm. long: "Bora", when longer than 300 mm., and "Toda" when still larger.

Type locality...........European Seas

Distribution: Nagasaki (TEMMINCK & SCHLEGEL); Tokyô mark et (TANAKA); Tokyô; Nagoya; Ôsaka (JORDAN); Kagoshima Bay, Kyûshû; Mikawa Bay, Shizuoka Prefecture; Fukuoka, Kyûshû; Lake Kasumigaura; Misaki, Kanagawa Prefecture (JORDAN & HUBBS); Hunakawa-ko, Minami-Akita-gun, Akita Prefecture; Hirota-mura, Kesen-gun, Iwate Prefecture; Hire-numa, Wakuya-machi, Toda-gun, Miyagi Prefecture; Matsushima-Bay, Miyagi-gun, Miyagi Prefecture; Yuriage, Natori-gun, Miyagi Prefecture; Torinoumi-ura, Arahama, Watari-gun, Miyagi Prefecture; River Mogami, Yamagata Prefecture (OKADA & IKEDA); Yokohama; Nagasaki (JORDAN & SNYDER).

Suborder Percina

Characters: Fins with spines. Ventrals thoracic or jugular, with 1 spine and not more than 5 rays. Caudal rays do not overlap hypural. Second infraorbital not united with preopercle.

Key to the Japanese families of suborder Percina

a[1] Dorsal with 12–14 spines.. **Theraponidae**

a[2] Dorsal with 6–11 spines

- b[1] Inner series of teeth in jaws enlarged and pepressible, dorsal with 6 or 7 spines .... **Serranidae**
- b[2] No depressible teeth, dorsal with 10 spines .... **Kuhlidae**

Family Kuhlidae

Characters: Oblong, laterally compressed body, covered with large ciliated scales; head partly naked; large protractile mouth; the maxillary exposed and without a supplemental bone; lower jaw projecting; jaw teeth in villiform bands; teeth on vomer, palatines, entopterygoids, and ectopterygoid, none on tongue; preorbital and preorpercle denticulate; opercle with two spines; lateral line complete, nearly straight.

Dorsal X, 9 to 13, the spinous portion longer than the rayed portion; anal equal to soft dorsal, III, 10 to 12; both dorsal and anal folding into a well-developed sheath; 6 branchiostegals; pseudobranchiae large; gill rakers long, slender, 9 or 10 + 18 to 25; vertebrae 25.

Genus Kuhlia GILL, 1861.

Kuhlia GILL, 1861, Proc. Acad. Nat. Sci. Phila., 13, p. 48.

Characters: Oblong body; head strongly compressed laterally; mouth oblique, short; maxillary 2 to 2.7 times in head.

Coloration silvery, in some species more or less spotted or mottled with olive brown or black.

103. Kuhlia marginata (CUVIER et VALENCIENNES).
Flagtail, "Yugoi"
(Text-fig. 107)

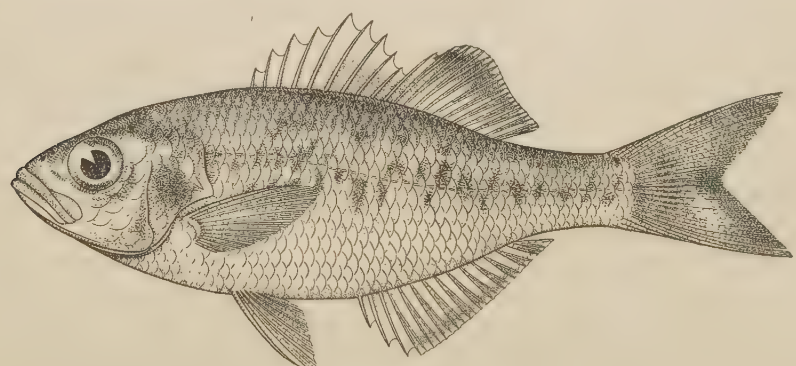
Dules marginata CUVIER et VALENCIENNES, 1829, Hist. Nat. Poiss., 3, p. 87, pl. 52. - HOMBRON et JACQUINOT, 1853, Voy. Pole Sud. Poiss., p. 41, pl. 3, fig. 3. - GÜNTHER, 1859, Cat. Fishes 1, p. 268.

Kuhlia marginata BOULENGER, 1895, Cat. Fishes, ed. 2, 1, p. 38. - JORDAN et SEALE, 1905, Bull. Br. Fisheries 25, p. 255. - JORDAN et RICHARDSON, 1907, Bull. Br. Fisheries 27, p. 254, - JORDAN et THOMPSON, 1918, Proc. U. S. Nat. Mus., 41, p. 525. - WEBER, 1913, Siboga Exp., Fische p. 194. - OKADA et IKEDA, 1938, Trans. Biogeo. Soc. Japan, vol. 3, no. 1, pp. 78–79, pl. ii, fig. 4.

Dules maculatus CUVIER et VALENCIENNES, 1831, Hist. Nat. Poiss., 7, p. 357. - FOWLER, 1930, Bull. 100, Unit. Stat. Nat. Mus., vol. 10, pp. 169–171.

Dules malo HOMBRON et JACQUINOT. 1846, Voy. Pole Sud, Poiss., p. 41, pl. 3, fig. 4.

Paradules marginatus BLEEKER, 1863, Ned. Tijd. Dierk, 1, p. 257.



Text-fig. 107. ***Kuhlia marginata*** (CUVIER et VALENCIENNES).

The original description* is as follows:

Dules marginata CUVIER et VALENCIENNES 1829.

Une autre espèce, envoyée aussi de Tava par les mêmes naturalistes, et que l'on possède au Musée royal des Pays-Bas et au Cabinet du Roi, comme la précédente, la forme d'une perche, la dorsale très-echancrée, sa partie épineuse plus haute dans le milieu, l'oeil grand; la mâchoire inférieure plus longue, la caudale fourchue, deux pointes à l'opercule, et la dentelure du préopercule si fine qu'on a peine à la voir a l'oeil nu. Son profil est rectiligne, ses écailles assez grandes (quarante à quarante-cinq sur une ligne longitudinale); sa couleur argentée, tetnte de gris vers le dos; ses nageoires d'un gris jaunâtre, avec une teinte noirâtre sur la caudale et la partie epineuse de la dorsale. La partie molle de la dorsale et ln caudale sont en outre liserées de noir, et il y a une tache noire à l'angle ante-

*CUVIER et VALENCIENNES, 1829, Hist. Nat. Poiss., 3, pp. 116–117, pl. 32.

rieur de la partie molle de la dorsale. L'épine de cette partie molle, qui est la dixième de la nageoire, est aussi haute que les rayons qui la suivent. La deuxième épine de l'anale est plus forte, mais un peu plus courte que la troisième. La ligne latérale est presque droite.

D. 10/11 (le dernier très-profondément divisé);
A. 3/12; C. 17; P. 13; V 1/5.

L'individu n'a que quatre pouces et demi de longeur.

Nous avons disséqué cette espècè elle a la vissie simple, longue et à parois minces, ce qui la rapproche des centropristes beaucoup plus que des thérapons, et huit coecum assez longs à son pylore. L'intestin fait deux replis; le dernier, ou le rectum, est très renflé.

Description: Head 2.9–3.1 in body length exclusive of caudal fin; depth 2.9–3.0 Eye 2.8 -3.0 in head; snout 3.4–3.6; interorbital space 2.9–3.2; depth of caudal peduncle 2.6–2.7. D. IX, 1, II – II + 1, A. III, II – II + 1. Scales in lateral line 37–40; 5 scales above lateral line 8–9 below, 8–9 predorsal. Gill rakers 15 + 7 – 15 + 18.

Oblong and compressed body 2.8 to 3. times in length, depth of the upper and lower outlines equally and almost evenly arched; the head much longer than deep, 3.2 to 3.5 times in length of body, its upper profile nearly straight; the compressed, rather long caudal peduncle lowest posteriorly, the least depth 2.2 to 2.7 times in head of 7.6 to 8.3 times in that of body; the wide interorbital space moderately convex, its narrowest portion 2.9 to 3.4 times in head; the diameter of the large, rounded eye from 3 to 3.4 times in length of head and slightly longer than snout, which is contained from 3.3 to 3.8 times; the long maxillary 2.1 to 2.5 times in head and extends posteriorlly to below anterior third of eye; the large mouth oblique, with the lower jaw slightly projecting; two nostrils close together, in front of each eye, the anterior one with a fleshy rim and the other a vertical slit; the preorbital coarsely serrated; the preopercle finely serrated on its lower and hind edges; the opercle armed posteriorly with two flat, rather sharp spines, the lower one much the stronger.

No scales on top of head and on snout, orbital ring, chin or both limbs of preopercle; lateral line highest anteriorly and curves downward below third and fourth dorsal spines; the fifth dorsal spine the highest and slightly higher than the last; the dorsal and anal rays decrease in heighest posteriorly, the anterior rays about as high as the highest dorsal spines; the caudal rather deeply forked, with pointed lobes; pectoral is contained from 1.4 to 1.8 times in length of head and terminates above the fifth to sixth scale in front of anus; ventral extends almost to anus.

Ground color in alcohol silvery grayish and frequently with irregular blackish spots above lateral line; soft dorsal and anal narrowly edged with white and having a blackish submarginal band which is broader in front; caudal narrowly edged with white above and below, black along the posterior border; black spot at axil of pectoral.

Type locality:

Distribution: Throught the East Indies and south eastward in the South Pacific from the Gilbert Islands to the Society Islands (Herre & Montalban); Itô, Shizuoka Prefecture (Okada & Ikeda); Amamiôshima, Yakushima; Tanegashima (Ogawa); Zyô no Ike, Itô, Izu; River Tozin Itô, Izu, Shizuoka Prefecture; (Kuroda); Wakanoura;

Tojimgawa, Idzu (ISHIKAWA);

Remarks: On the pattern of caudal fin of this species, F. DAY (1889) noted "a dark gray band across the posterior third to the caudal fin, the border of which is white", while A. W. HERRE and H. R. MONTALBAN (1927) described "the caudal fin is narrowly edged with white above and below, and has a blackish posterior border". All of our specimens from Okinawa Islands rather agree with the descriptions of the Philippine specimens described by A .W. HERRE and H. R. MONTALBAN.

Family Serranidae

Characters: Body oblong, compressed. Mouth protractile, large or moderate, not very oblique; maxillary expanded distally, usually not slipping for the whole length into a sheath formed by prefrontal, which is usually narrow. Supplemental maxillar present or absent. Nostrils two on each side. Teeth conical or pointed, in bands, present on jaws, vomer and palatines, rarely no tongue and pterygoid. Operculum with one to three flat spines; preopercular margin usually more or less serrate, rarely entire. Gillakers long or short, usually stiff, armed with teeth. Gills 4, a long slit behind the fourth.

Pseudobranchiae present, large. Lower pharyngeals rather narrow, with pointed teeth separate. Gill membranes separate, free from the isthmus. Spinous dorsal usually well developed, with 2 to 15 spines; soft dorsal with 10 to 13 rays; anal fin rather short, spinet usually 3, rarely 2 or absent soft 7 to 12. Ventral thoracic, usually 1, 5, without distinct axillary scale. Pectorals well developed, with narrow base. Caudal with 15 to 17 principal rays, 13 to 15 of which are branched. Scalee moderate or small, cycloid or mostly ctenoid, sometimes embedded in the skin. Lateral line usually complete and single, not extending on caudal. Air bladder present, usually small and adherent to the wall of the abdomen. Stomach coecal, marine fishes of tropical and warm seas, some living in fresh and brackish water, and mostly valuable as food.

Key to the Japanese subamilies of Serranidae

a1 Two dorsals entirely separated or connected merely at their beses; last dorsal spine much longer than the penultimate one; third opening of sensory canal on frontals widely apart from each other, and not bearing lateral branch .... **Macculochellinae**

a2 Dorsal single, deeply notched; last dorsal spine subequal to penultimate one in length; an inner short branch of sensory canal on posterior part of frontal bone extends forward and inward, and yet leaves an untouched small room between it and fellow of opposite side .... **Polyprioninae**

Subfamily Macullochellinae

Type: **Macullochella** WHITLEY.

Characters: Body elongate, compressed. Mouth large, protractile; maxillary with a supplemental bone. Nostrils two on each side, close together, directly in front of eye. Villiform teeth on jaws, vomer and palatines; tongue smooth. Two dorsals, connected

at their bases; base of the spinous portion longer than that of the soft portion; dorsal rays XI to XV, 12 to 16; anal rays III, 8 to 13; pectoral obtusely pointed, asymmetrical; caudal round or emarginated. Scales small, ctenoid; lateral line slightly curved.

Suborbital shelf developed on 2nd suborbital bone. Preopercle serrated; opercle with one or two spines. Urohyal rather small; branchiostegal rays 7. Airbladder large, the external wall thick; posterior end of the bladder enters into a hollow of lst interhaemal spine. Pyloric coeca long.

Genus **Lateolabrax** Bleeker, 1857.

Lateolabrax Bleeker, 1857, Verhamdel, Bataviaesch Genoot, xxvi, p. 53.

Type: **Labrax japonicus** Cuvier et Valenciennes.

Characters: Body elongate, compressed. Mouth large, oblique and protractile; maxillary with a supplemental bone. Villiform teeth on jaws, vomer and palatines; tongue smooth. Gill-rakers long and slender. Two dorsals connected at their bases; base of spinous portion much longer than that of soft portion; dorsal rays XII to XV, 12 to 16, anal ray, III, 7 to 10; pectoral obtusely pointed the upper rays longest; caudal emarginated. Scales small, ctenoid; lateral line slightly curved.

Suborbital shelf developed on secnd suborbital bone. Preopercle serrated along the posterior border; opercle with two spines. (Vertebrae 34 to 37 inclusive of hypural). Airbladder large; external wall thick; posterior end of the bladder enters into a hollow of lst interhaemal spine. Pyloric coeca long, about 13 to 15.

104. **Lateolabrax japonicus** (Cuvier et Valenciennes).
Seabass, "Suzuki"
(PL. LII, figs. 1–13; Text-fig. 108)

Labrax japonicus Cuvier et Valenciennes, 1828, Hist. Nat. Poissons, III, pp. 116–117, pl. 32.

Perca-labrax japonicus Temminck et Schlegel, 1842, Fauna Jap. Poiss., p. 7, pl. ii, fig. 1.

Lateolabrax japonicus, Bleeker, 1857, Verh. Batav. Gen., xxvi, p. 53. – Jordan et Thompson, 1914, Mem. Carn. Mus., vol. vi, no. 4, p. 248. – Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 234. – Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 234. – Kamohara, 1931, Zool. Mag., 43 (508), p. 87, – Nichols, 1948, Freshwater Fishes China, p. 246. – Ui, 1932, Kishû Gyofu, p. 130. – Miyadi, 1935, Kyôto fuka Tansuigyo, p. 41, pl. 5, fig. 37. – Okada, Uchida et Matsubara, 1935, Nihon Gyorui Zusetsu, p. 141, pl. 65, fig. 1. – Kimurr, 1934, Fish. Yomgtzekiang, China, pp. 196–199. – Okada et Nakamura, 1948, Nihon Tansui Gyorui, pp. 193–194, fig. 124.

Holocentrus maculatum McClelland, 1844, Calc. Journ. Nat. Hist., iv, p. 395, pl. 21, fig. 1.

Labrax luyii Basilewsky, 1855, Nouv. Mem. Soc. Nat. Moscou, x, p. 219.

Percolabrax japonicus Günther, 1859, Cat. Fish. Brit. Mus., vol. 1, p. 71. – Steindrchner et Döderlein, 1883, 20, pl. 4, fig. 3.

Percolabrax tokioensis Steindachner et Döderlein, 1883, p. 20.

The original description* is as follows:

*Cuvier et Valenciennes, 1828, Hist. Nat. Poissons, III, pp. 116–117.

La Bar du Japon (*Labrax japonicus, nob*)

Les mers du Japon possedent aussi un bar bien caracterisé qui en a été rapporté par M. de LANGSDORF.

Son préopercule a cinq petites épines recourbées en avant, dont trois à l'angle et deux seulement au bord inférior. Les dentelures du bord montant sont excessivement fines. L'épine superieure de l'opercule est très obluse: sa premièse dorsale a onze rayons, et elle sélève beaucoup plus que dans le bar d'Europe: sou son quatieme et son eniquieme sayon, qui sont les plus élevés out les trois quarts de la hauteur du corps; la deuxieme a treize ou quatorze reyons mous. L'anale a aussi la deuxieme et la troisieme épine bien plus lengues qu'à notre bar; elles égalent presque celles de la première dorsale et les premiers rejons mous. Ceux-ci sont au nombre dehint.

D. 11 – $^1/_{13}$ ou 14; A. $^3/_8$; C. 17, P. 16; V. $^1/_5$

L'individu que nous decrivous et qui appartiment an Musée de l'université de Berlin, est long de onge pouces. Il parait encoré sur son dos quelques restes la rapport de la couleur, c'est que la membrane de sa premiere dorsale dans les intervalles des rayons des taches sondes et brunes. Il y en a aussi, Mais de moins nettes, su la deuxieme. La membrane de la caudale est brune; le reste du corps, autant qu'on en peut juger à l'etat sec, parait avoir été argente.

Le nom japonais de ce poisson est Susuki.



Text-fig. 108. ***Lateolabrax japonicus*** (CUVIER et VALENCIENNES).

Description: Depth in length to base of caudal, 3.7; head, 3; eye in head, 4.6 (specimen of 161mm. standard length). Dorsal rays, XI or XII–I or II, 12 to 14; anal, III, 8 or 9; scales 100 to 115.

Body elongate and compressed; back slightly elevated; head moderate and pointed; mouth oblique, protractile. Maxillary extending beyond posterior margin of eye, with small supplemental bone; maxillary length 2 $^1/_2$ in head. Lower jaw slightly projecting. Teeth small, villiform; arranged in narrow lines on jaws, vomer and palatines. Tongue toothless and the tip rounded. Snout moderate, its width 1 $^1/_2$ in its length. Nostrils close together, anterior one the larger, providing with a flap. Eye moderate, a little shorter than snout. Interorbital space slightly convex, somewhat shorter than eye. Posterior margin of opercle serrated, with a few antrose spines at the angle and lower margin; opercle ending in a flat spine.

Gill-membranes free from isthmus. Gill-rakers lanceolate, slender, longer at the angle.

The insertion of dorsal a little before the ventral; fifth spine the longest, $1\,{}^{6}/_{7}$–2 in head, shorter than the branched ray measured $1\,{}^{3}/_{4}$ in head. Spinous and soft dorsal base connected, 2 and more in body. Pectoral $1\,{}^{3}/_{4}$ in head; ventral $1\,{}^{5}/_{8}$ in head, extending half the distance between ventral origin and third spine of anal. Anal inserted nearer the caudal base than to the ventral origin; second spine strongest and longest, $1\,{}^{5}/_{6}$ in head, the longest branched ray a little longer than the spine. Caudal peduncle extremely compressed; isthmus. Gill-rakers lanceolata, slender, longer at the angle.

The insertion of dorsal a little before the ventral; fifth spine the longest, $1\,{}^{6}/_{7}$–2 in head, shorter than the branched ray measured $1\,{}^{3}/_{4}$ in head. Spinous and soft dorsal base connected, 2 and more in body. Pectoral $1\,{}^{3}/_{4}$ in head; ventral $1\,{}^{5}/_{8}$ in head, extending half the distance between ventral origin and third spine of anal. Anal inserted nearer the caudal base than to the ventral origin; second spine strongest and longest, $1\,{}^{5}/_{6}$ in head, the longest branched ray a little longer than the spine. Caudal peduncle extremely compressed; its least depth $1\,{}^{5}/_{6}$–2 in the length.

Scales small, semi-square: outer margin serrated; moderate size 4 in eye-diameter, provided with 7–11 basal striae and 34–38 serrations along outer margin. Head and body scaled. Lateral line continuous, slightly curved below at the spinal dorsal and extended to caudal base. Tube of lateral line broad and simple, 2 in that scale.

Color in fresh, greyish on dorsal and silvery below. The back and dorsal fin with black spots scattered irregularly. Caudal fin light greyish; pectoral, ventral and anal pale.

Type locality ....Japan.

Habits: The breeding habit is unknown. Around Tôkyô, one year youngs (called "Seigo" in Japanese) hatched out in the sea, grow 30–70 mm. long, and ascend into the river during the end of March and the middle of April in group, and they reach the upper region of 30–40 km. from the mouth of river and grow rapidly into 200 mm. long by November. They descend again the river into the sea when the water temperature goes down to stay three years adult. At this age, the fish ascend into the river in the spring and again in the autum descend into the sea, annually. As the fish grow older, the intervals of ascending and descending period become shorter. They like to gather in the sandy bottom and in the deep of the current water. They eat small fishes, *Hypomesus*, *Salangichthys* and *Ctenogobius* ("Isaza"), *Crustaceans*, *Worms* and sometimes weeds.

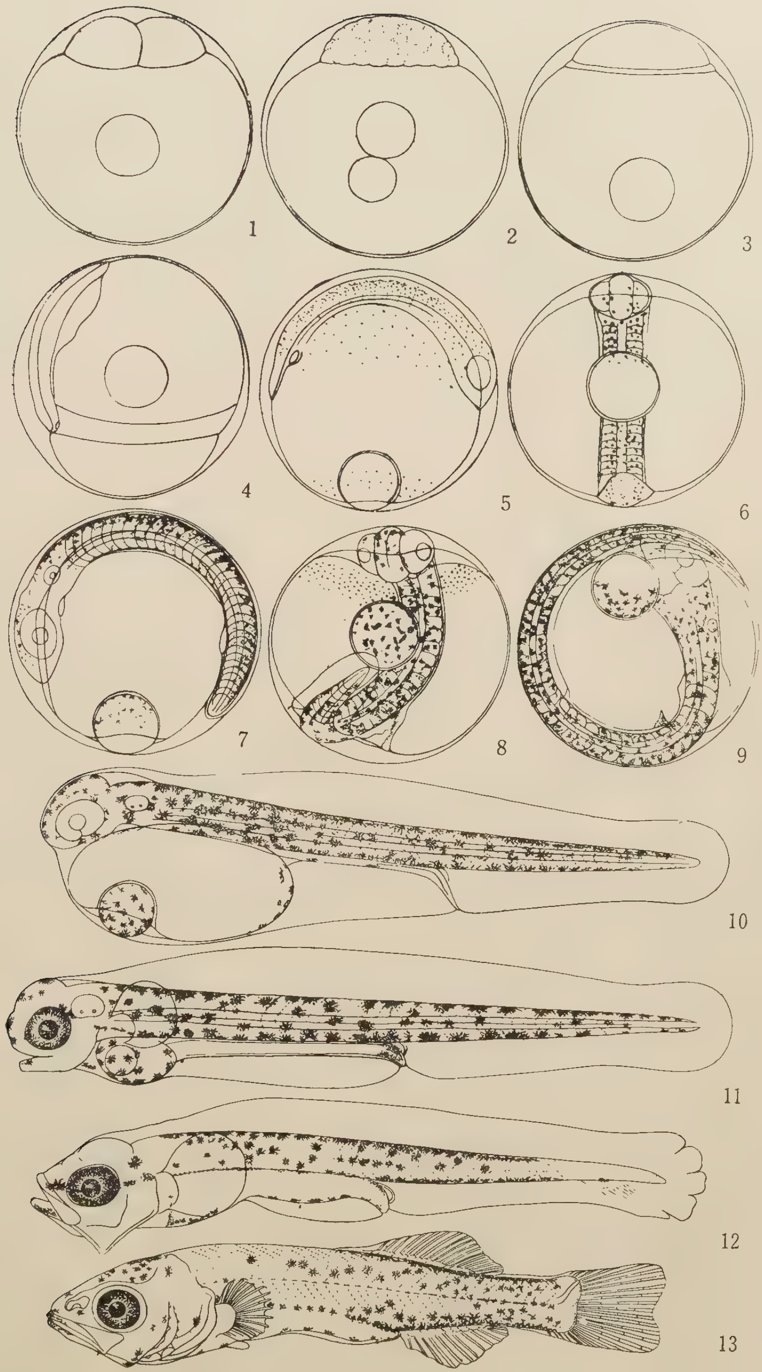
Distribution: The present species is distributed widely from Hokkaidô to Kyûshû. Ningpo; Shanghai; Chinwangtao (GEE); Fukien; Canton (NICHOLS); Sapporo, Hokkaidô (MAJIMA); Tôkyô; Kôbe (JORDAN); Kagoshima Bay (WAKIYA); Mikawa Bay (ISHIKAWA); Miyazu, Kyôto; Fukuoka (HAMADA); Lake Kasumigaura (HATTORI); Sapporo market, Hokkaidô (MAJIMA); Tôkyô and Kôbe markets (JORDAN); Kagoshima Bay (JORDAN & RICHARDSON, WAKIYA); Mikawa Bay (ISHIKAWA); Miyazu, Kyôto Fu; Fukuoka (HAMADA); Lake Kasumigaura (HATTORI); Shimonoseki, Yamaguchi Prefecture, Shimabara, Nagasaki Prefecture (JORDAN & THOMPSON); Kôchi market, Kôchi Prefecture (KAMOHARA); Nagasaki (TEMMINCK & SCHLEGEL, JORDAN & SNYDER, JORDAN &

PLATE LII

Development of ***Lateolabrax japonicus*** (CUVIER), after SATOSHI MITO (1957).

1. 2-cell stage, 2° 10' after fertilization.
2. Morula stage, 10° afuer fertilization.
3. Blastula stage, 20° after fertilization.
4. Formation of early embryo, 36° after fertilization.
5. Embryo with ten myotomes and black and yellow chromatophores, 40° aftre fertilization.
6. Embryo with 22 myotomes, 60° aftre fertilization.
7. Embryo with 32 myotomes, 80° after fertilization.
8. Advanced embryo with a hatching gland, 96° after fertilization.
9. Embryo just before hatching, 104° after fertilization.
10. Larva just hatched, 4. 5 mm. in body length.
11. Larva 5 days after hatched, 5. 13 mm. in body length.
12. Juvenile, 6. 48 mm. in size.
13. Juvenile, 13. 7 mm. in size.

PLATE LII



RICHARDSON); River Chikugo, Kumamoto Prefecture (JORDAN & RICHARDSON); River Shiota, Saga Prefecture (KATAYAMA); Kurume, Fukuoka Prefecture; Fukuoka, Fukuoka Prefecture (JORDAN & HUBBS); Bôfu, Yamaguchi Prefecture (KATAYAMA); Hiroshima (JORDAN & RICHARDSON); Onomichi (JORDAN & RICHARDSON); Wakanoura, Wakayama Prefecture (JORDAN & RICHARDSON); Miya, Aichi Prefecture (KATAYAMA); Shimoda, Shizuoka Prefecture (BREVOORT, JORDOSON & SNYDER); Enoshima (GUNTHER); Misaki Aburatsubo Kanagawa Prefecture (FRANZ, SNYDER); Yokohama, Kanagawa Prefecture; (FRANZ, JORDAN & SNYDER); Matsushima, Miyagi Prefecture (JORDAN & RICHARDSON); Hakodate, Hokkaidô; Volcano Bay Hokkaidô (JORDAN & RICHARDSON, HIKITA); Hamada; Kasumi, Hyogô Prefecture; Miyazu; Tsuruga Kyoto Fu (FOWLER, JORDAN & RICHARDSON); Toyama Bay (KATAYAMA); Niigata Prefecture (HONMA & KATAYAMA); Hakata Bay; River Muroui, Fukuoka, Fukuoka Prefecture; Tomiôka, Amakusa, Kumamoto Prefecture; Tamano-ura, Nagasaki Prefecture (MITO).

Sudfamily Polyprioninae

Type: **Polyprion** CUVIER.

Characters: Body elongate, compressed. Mouth large, oblique and protractile; maxillary large, with a well developed supplemental bone. Nostrils two on each side, close together, directry in front of eye. Teeth on jaws small or somewhat enlarged; a band of small teeth on palatines and vomer; tongue smooth. Dorsal deeply notched; base of spinous portion much longer than that of soft portion; dorsal rays XI to XIII, 9 to 15; anal rays III, 7 to 10; pectoral and caudal rounded. Scales either small or moderately large, cycloid or ctenoid; lateral line slightly curved.

Suborbital shelf developed on second suborbital bone. Preopercle serrated along the posterior border, some antrorse spines on the lower border; opercle with two spines; subopercle and interopercle smooth or serrated. Branchiostegals 7. Vertebrae 26 to 30 inclusive hypural. Posterior cavity of air-bladder rather large. Pyloric coeca few or many.

Genus Coreoperca HERZENSTEIN, 1896.

Coreoperca HERZENSTEIN, 1896, Ann. Mus. Zool. Acad. Sci. St. Petersburg, I, p. 11. Type: *Coreoperca herzi* HERZENSTEIN.

Bryttosus JORDAN et SNYDER. 1901, p. 354. Type: *Serranus Kawamebari* T. et SCH.

Characters: Small compressed, rather short-bodied, freshwater, perch, like fishes. Scales rather small (50 to 80), cycloid, concentrically striated; lateral line complete, its tubes straight, occupying the greater length of the scale. Mouth large, protractile; maxillary exposed, with a supplemental bone; villiform teeth in jaws and on vomer and palatines; no canines and no teeth on the tongue. Head partly scaleless. Preopercle serrated; with a few antrorse spines on the lower border; opercle with 2 spines. Gill membranes separate; 7 branchiostegals; pseudobranchiae present. Dorsal fins-confluent, XIV or XV, 11 to 17, the spinous portion much longer than the soft; anal short, III, 7 to 12; caudal rounded. Pectoral symmetrical; ventral with a strong spine and 5 branched rays, the last of which is connected with the belly by a membrane.

105. **Coreoperca kawamebari** (TEMMINCK et SCHLEGEL).

Rock-cod, "Kawamebaru, Oyanirami".

(PL. LIII, figs. 1–17; Text-fig. 109)

Serranus kawamebari TEMMINCK et SCHLHGEL, 1842, Fauna Japon. Poiss., p. 5. – GÜNTHER, 1859, Cat. Fish., 1, p. 107.

Siniperca ? **kawamebari** BOULENGER, 1895, Cat. Fish., p. 138.

Coreoperca kawamebari, OKADA et NAKAMURA, 1948, Nihon Tansuigyo, pp. 194–195, fig. 125.

Bryttosus kawamebari JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. XXIII, p. 354, pl. 12. – JORDAN et RICHARDSON, 1910, Proc. U. S. Nat. Mus., XXXVII, p. 433, fig. 3. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. X, no. 2, p. 235. – MIYADI, 1935, Kyôto fuka Tansuigyo, pp. 40–41, pl. 2. – TANAKA, 1921, Fish. Japan, pp. 618–619, pl. CL. fig. 412.



Text-fig. 109. ***Coreoperca kawamebari*** (TEMMINCK et SCHLEGEL).

The original description* is as follows:

Serranus Kawa-mebari

Cette petite espece, pui n'excède guère quatre pouces en longueur, appartient à la division des Serrans proprement dits ou à mâchoires nues, et parait remplacer dans les mers du Japon notre *Serr.. hepatus* de la Méditerranée, qui nous a été également envoyé du Cap de B. Esp. Les formes sont à-peu-près les mêmes que dans le *Serr. hepatus,* mais le système de coloration est différent. Le bord du préopercule est muni de dents fines mais assez profondes et en peigne; dans l'un de nos individus son angle est divisé en deux lobes arrondis; dans un autre on voit au devant de son bord horizontal une dent isolée très forte. Les bords de l'interopercule sont également pourvus de dentelures très fines. L'opercule est revêtu d'écailles plus grandes que le préopercule, et muni de deux pointes assez aigues, entre lesquelles se trouve une profonde échancrure sémilunaire. Le surscapulaire forme, si l'on veut, une troisième pointe, mais qui est arrondie et finement dentelée. Les écailles du corps sont plus grandes que dans le Serr. hepatus. La ligne latérale est parallèle avec le dos, mais en avant elle forme une légère courbure. La nageoire dorsaleest assez longue et peu élevée en avant; ses trois rayons antérieurs diminuent peu-à-peu en longueur. La pectorale est plus petite que celle du *Serr. hepatus,* l'anale au contraire est plus longue; la caudale est très peu arrondie à l'extrémité. Les dents des mâchoire sont nimbreuses, en forme de carde, et il s'y trouve des canines faibles; le vomer et les palatins sont également pourvus d'un grand nombre de petites dents. – D. 12+12; A. 2+10. – Dans nos individus

* TEMMINCK et SCHLEGEL, 1842, Faun. Jap., Poiss., p. 5.

empaillés, la couleur générale est d'un brun-gris assez clair; la dorsale épineuse est d'un brun-foncé; on voit sur le tronc des traces de cinq bandes transversales, et str la nâgeoire molle du dos, sur la caudale et l'anale les restes de petites taches disposées en séries, absolument comme on le voit sur la caudale du *Serr. hepatus*, Mais ce qui caractérise particulièrement cette espèce, c'est une grande tache noire sur la membrane qui remplit la profonde échancrure semilunaire de l'opercule; on remarque en outre sur le préopercule deux lignes brunes, qui viennent de l'aeil et dont l'inférieure va au bord du préopercule. Nous avons laissé à cette petite espèce le nom qu'elle porte au Japon.

Description: Head 2.71 in total length without caudal; depth 2.84; eye 4.33 in head; interorbital 4.64; snout 4.06; depth of caudal peduncle 2.71; maxillary 2.17; width of its distal extremity 6.5; width of preoprbital 7.22; fourth and fifth spine of dorsal lach 4.64; sixth 4.06; seventh and eighth each 3.82; longest ray 2.1; first spine of anal 7.22; second and third each 3.82; longest ray 2.03; longest ray of pectoral 2.03; spine of ventral 3.61; longest rays 2.32. B. 7; D. XII, 12; A. III, 9; P. 1, 10, or 11, 1; V. I, 5; C. 4, 1, 15, 1, 4; scales 10-38-17; pores 37.2.

Body oblong, compressed, moderately elevated in front of dorsal, lower outline subhorizontal; caudal peduncle shortish, strongly compressed. Head short, compressed, with an almost straight profile which is slightly concave above eye; eye moderately large, high up; interorbital rather wide, flattish between superorbital ridges; snout short, its profile steep but substraight, angular over tip of premaxillary process; nostrils two, subequal in size, anterior with elevated rim; posterior nostril subtriangular, without elavated rim, preorbital moderately wide; the width 1.67 in diameter of eye; maxillary with a distinct supplemental bone, scarcely reaching vertical through posterior border of eye, its posterior margin emarginate, with rounded upper and lower angles. Mouth large, oblique, with lateral cleft; the lower jaw projecting, in line with profile of snout; teeth in jaws villiform, in narrow bands a little more widened anteriorly; those in lower jaw in two rows; outer teeth in both jaws a little larger; no canines; villiform teeth on vomer and palatines; tongue smooth; preopercle with rounded angle which are moderately denticulated, the serratus gradually decreasing in degree on posterior limb, its lower limb sinuate; opercle with two subequal flat spines. Gill openings wide, continued forward beneath; the membranes separate, free from the isthmus; gills 4, a slit behind the last; pseudobranchiae moderately developed; gill-rakers on first gill-arch very short, flattish, enlarged at tip, 7 + 13, the longest 2.75 in diameter of eye. Dorsal inserted slightly behind base of pectoral, gently notched at the beginning of soft portion; the spines short, pungent, broadly rounded in free margin; soft portion very broadly rounded in free margin, the rays abruptly becoming much shorter posteriorly; anal inserted below spine of dorsal, second spine equal in length to third but a little more slender; soft portion similar in form to that of dorsal, reaching a little beyond base of caudal like the latter fin; pectoral low down, extending to vertical through eighth spine of dorsal; ventrals inserted slightly behind pectoral, close together, extending below nineth spine of dorsal; vent very close to anal caudal broadly rounded. Scales moderately large, cycloid, not deciduous; head naked except cheek and opercle; both dorsal and anal with scaly sheath; lateral line high, complte, concurrent with back.

Color in formalin, dark bluish brown, with obscure 5 to 6 darker cross-bands, on posterion two thirds of body and caudal peduncle; cheeks crossed by dusky red lines radiating from eye; a round black blotch on margin of opercular flap between the spines, anterior portion of the blotch orange.

Four lines radiate from eye; first forward from eye, second from eye downward to a little beneath upper end of posterior limb of preopercle; and the last from supero-posterior angle of eye over preopercular limb to a point on opercular part; from this line set off a line running upward and backward which joins its fellow on opposite side by a lIne on occipital; a rather indistinct line on interorbital extending into iris of eye, extending on maxillary; another line on back of snout along middle line to premaxillary and also to mandible where it is divided into two, on the edge of opercular flap a large blackish spot surrounded by paler ring; soft portion of dorsal and anal dusky, with a few rows of darker spots; spinous part of the former fin much darker; caudal and pectoral light dusky, the former growing darker toward base; ventral dusky, much darker basally. (by Sh. Tanaka)

Type locality; Nagasaki.

Habits: The present species is dwelling in gentle streams. The breeding season is in spring; the female depositing eggs of diameter 0.6 mm. on stems of water plants. The male is protecting eggs from enemies by the fin to send water currents. The egg are hatching out about 17 days in the water temperature 16°–18°C.

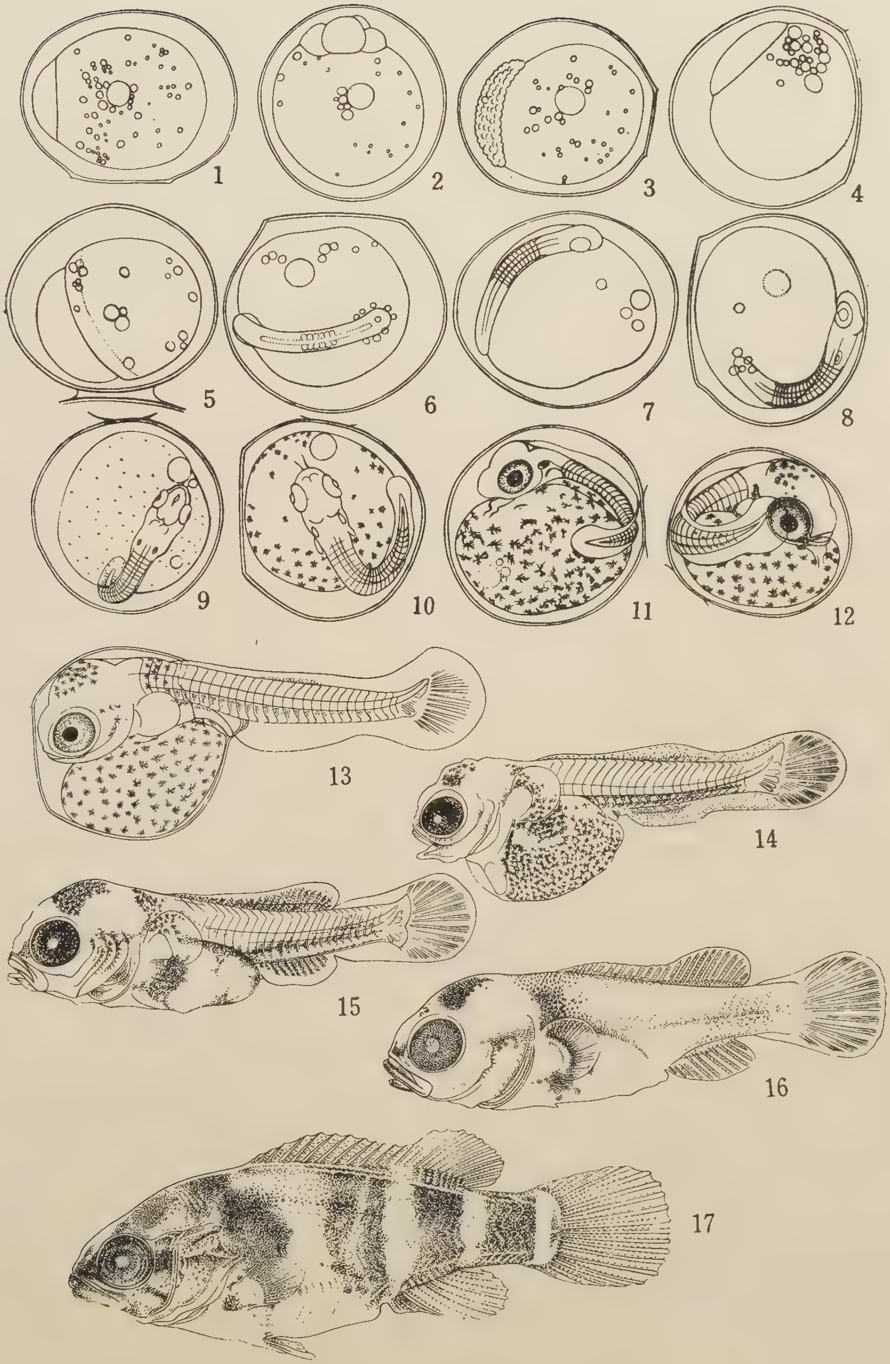
Around the River Yanagawa, Kyushû, the breeding season occurs in April. In this season, the male shows a bright color and struggles in scramble for the females. In the spring and summer, they appear in a stream or a channel in the shadow of weeds and in the end of autumn, they migrate into the deep of ponds and swamps for sleeping in winter.

Distribution:– River Hotsu, Kyôto (on Pacific coast); River Yura, (Okada & Nakamura); Tsuyama, Okayama Prefecture (Kawamura); Kyôto (on Japan sea coast); Kumamoto (Wakiya); Himeji, Hyôgo Prefecture (Abe); Fukuoka (Hamada); River Haura, above bay of Shimabara (Jordan & Snyder); River Yabe at Riverr Yama, Kyûshû; River Yabe at Funayado, Kyûshû (Jordan & Snyder); Chûgoku, the eastern limit of the range being Otanasegawa (tributary of the River Yodo) at Fukuchiyama on the Japan sea side and the River Hodsu (tributary of the River Yodo) at Kamenka on the Sanyôdô side; Chikuzen; Chikugo; Hizen; Higo from Kumamoto northward and in Buzen from Toyotsu northward; River Otanase (tributary of the River Yura), at Fukuchiyama, Prov. Tanba (Tanaka): River Oseki, the upper of River Yodo, Kyoto, (Matsuura); River Hotsu, Kyôto (Tanaka); River Kako, Kashira, (Nakagawa); Himeji, Hyôgo Prefecture (Jordan, Hubbs); River Iho (Ogami); River Yoshii (Matsuura, Tanaka, Hubbs); River Ota (Kobayashi); River Kotô, Yamaguchi Prefecture (Aoyagi); Kagawa Prefecture (Tanaka); Toyotu, Fukuoka Prefecture (Tanaka); upper River Yura (Tanaka); upper River Eno (Kobayashi); River Takatsu, Shimane

PLATE LIII

Development of ***Coreoperca kawamebari***, after IMAI, SADAHIKO and NAKAHARA, KANTARÔ (1957).

1. Egg with blastoderm formation.
2. 4 cell stage, 2° after ferilization.
3. Morula stage, 4-8° after fertilization.
4. Blastula stage, 12° after fertilization.
5. Gastrula stage, 30° after fertilization.
6. Blastopore closed, 42° after fertilization.
7. Optic vesicle formation, 39° after fertilization.
8. Optic cup and auditory vesicle formation, 47° after fertilization.
9. Embryo with beating heart, melanophores on eye cup, 51° after fertilization.
10. Pectoral fin formation, 83° after fertilization.
11. Dense melanophores on eye cup, 95° after fertilization.
12. Melanophores on head, 170° after fertilization.
13. Larva just hatching, 195° after fertilization.
14. Larva one day after hatching, in 5. 6 mm. body length.
15. Larva absorbed yolk sac, 10 days after hatching, in 7. 0 mm. body length.
16. Ventral fin formation, 9 mm. body length.
17. Lateral line formation, 13. 6 mm. body length.


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Prefecture (MATSUURA); Nagasaki Prefecture; River Chikugo; River Yabe (AOYAGI); River Kikuchi, Kumamoto Prefecture (TANAKA); Kumamoto (JORDAN & HUBBS); Fukuoka, (JORDAN & HUBBS); River Saba; River Shimada, Yamaguchi Prefecture (KATAYAMA); River Yoshii, Okayama Prefecture (JORDAN, HUBBS, MATSUURA, TANAKA); River Ibo, Hyogo Prefecture (OKAMI); Himeji (JORDAN & HUBBS); River Sbu, Yamaguchi Prefecture (KATAYAMA); River Maruyama, Hyôgo Prefecture (KATAYAMA); River Doki, Kagawa Prefecture (OKADA & NAKAMURA).

Remarks: MIYADI* said the distribution of the present species is somewhat limited in Honshû. The northern limit is River Katsura, Kyôto on the Pacific coast while on the Japan Sea coast, Yura River near Ayabe, Kyoto Fu. It is known from the western part of Honshu as well as from River Yana, Fukuoka Prefecture, Kyûshû.

Table 113. Measurements of *Coreoperca kawamebari* (TEMMINCK et SCHLEGEL).

Collection	Fish. Mie Univ.†				
Total length	68.0mm.	56.0mm.	55.0mm.	50.0mm.	34.0mm.
Body length	47.0	45.0	44.0	41.0	27.8
Body length/Head	2.40	2.54	2.50	2.49	2.38
Body length/Depth	2.52	2.57	2.56	2.53	2.60
Body length/Predorsal length	2.24	2.50	2.45	2.28	2.14
Body length/Prepectoral length	2.38	2.37	2.42	2.41	2.38
Body length/Peventrral length	2.19	2.25	2.10	2.12	2.32
Body length/Preanal length	1.47	1.41	1.48	1.45	1.46
Head/Snout	4.08	3.54	4.00	3.94	3.34
Head/Upper jaw	2.62	2.64	2.52	2.54	2.60
Head/Interorbital width	5.17	4.43	5.03	4.70	4.33
Head/Diameter of Eye	4.67	4.02	3.74	3.66	3.65
Head/Length of Caudal peduncle	3.02	2.60	2.84	2.84	2.92
Head/Depth of Caudal peduncle	2.93	2.64	2.62	2.75	2.78
Head/Length of Dorsal fin I	0.85	0.81	0.79	0.89	0.94
Head/Length of Dorsal fin II	1.32	1.28	1.30	1.29	1.43
Head/Length of Anal fin	2.23	2.04	2.00	2.14	2.34
Head/Height of Dorsal fin I	3.27	2.81	3.08	3.30	2.79
Head/Height of Dorsal fin II	2.13	2.16	2.00	2.20	2.21
Head/Height of Anal fin	2.18	2.04	2.02	2.17	2.09
Head/Pectoral length	1.96	1.81	2.00	1.88	1.80
Head/Ventrallength	1.96	2.04	1.96	1.94	1.88
Date	16, VIII, 1955				
Locality	River Kikuchi, Kyûshû				

† Faculty of Fisheries, Prefectural University of Mie.

In 1957, SADAHIKO IMAI, and KANTARO NAKAHARA**, studies the life history of *Coreoperca kawamebari* (T. et SCH.). They described that the present species may mature in size of 50–100 mm., sometimes attain 130 mm. in maximum length. They are living in the clear middle or upper stream, hiding alone in weeds or caves, sometimes swimming out in the middle layer of waer. Fighting habits are distinct. They feed on small

* MIYADI, 1935, Kyôto Fuka no Tansuigyo, p. 40.

** IMAI, SADAHIKO and NAKAHARA, KANTARÔ, 1957: Suisangaku Shûsei, pp. 591-601, figs. 1-37, tables. 1-3. (in Japanese).

aquatic animals insects, molluscs and fishes. Breeding season occurs from May to June, under the water temperature of 18–25°C. During this season, the female and male are in pairs, and the female depositing about 700 eggs (about 80 mm. sized female) on stems of water plants. The male are protecting eggs and larvae until hatching. The hatched larvae are usually swimming in a group, in the middle layer of water. If one of the larvae is apart from each other, the male put it in his mouth and bring it into the group again. Eggs cubical, demersal, measuring 2.2–2.4 mm. in diameter. Yolk is light yellow, with many oil globules. They hatch out within 8–10 days after fertilization, under the water temperature of 20–25°C.

Family Teraponidae

Characters: Body oblong, compressed, Mouth moderate. Teeth villiform in jaws, outer sometimes enlarged. Vomer and palatines with deciduous teeth, sometimes absent. Prepercle serrated. Opercle with one or two strong spines. Preorbital entire on serrate. Branchiostegals 6. Air bladder divided in two sections by constriction. Pyloric caeca moderate in number. Scales moderate or small in size. Dorsal fin notched, wiih 12 or 13 spines. Anal spines 3.

Genus Terapon Cuvier, 1817.

Therapon Cuvier, 1817, Regne Animal, vol. 2, p. 295.

Type: **Holocentrus servus** Bloch.

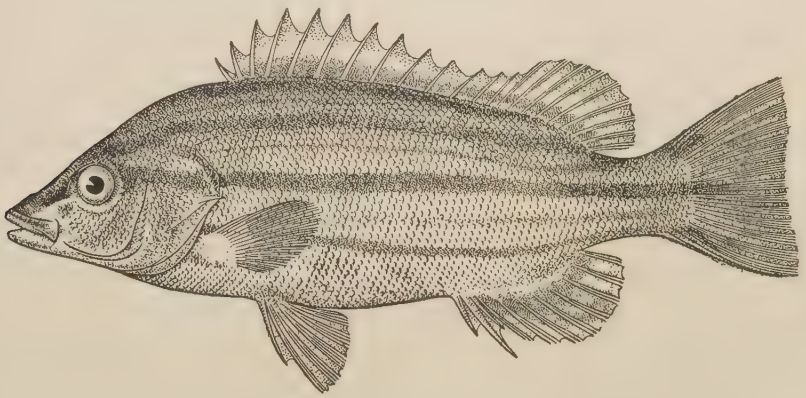
Characters: Body ovate to elliptical, extremely compressed. Head moderate to large. Snout long, Mouth moderately large, terminal, protractile, cleft oblique, jaws equal. Maxillary exposed terminally or behind, without supplemental bone. Lips plicate, rather thin. Teeth in jaws in band, or outer row enlarged or conic; variably caducous when present on vomer and palatines. Preorbital serrate in young. Preopercle more or less strongly serrated. Opercle with one or two pungent spines. Suprascapula and coracoid usually exposed. Gill membranes separate, free from isthmus. Gill rakers moderate, short, stout. Branchiostegals 6. Pseudobranchiae present. Air bladder divided, with front section shorter than hind section. Pyloric coeca few or moderate. Vertebrae 25, of which 13 to 15 caudal. Scales ctenoid. Preorbital usually partly with cycloid scales. Dorsal and anal with basal scaly sheaths. Lateral line complete, reaches causal base, tubes simple and of moderate size. Dorsal divided in two parts by deep notch, with 11 to 13 spines, rays 8 to 14. Anal spines 3, rays 7 to 12. Pectoral rays 12 to 16, fin pointed to rounded. Ventrals close together, inserted well behind pectorals.

Indo-Pacific region, some in freshwater, where they exhibit great vasiation incolor markings. All are fishes of small or moderate size.

106. Terapon oxyrhynchus TEMMINCK et SCHLEGEL.
Crescent perch, "Shimaisagi"
(Text-fig. 110)

Therapon oxyrhynchus TEMMINCK et SCHLEGEL, 1842, Faun. Japon., Poiss., p. 16, pl. VI, fig. 3. – BLEEKER, 1857, Nieuwe Nalez., Verh. Bat. Gen., XXVI, p. 64. – RICHARDSON, 1846, Ichth. China and Japan, p. 239. – GÜNTHER, 1859, Cat. Fish., I, p. 281. – BLEEKER, 1879, Enum. Poiss., Verh. kon. Akad. Amst., XVIII, p. 7. – STEINDACHNER et DODERLEIN, 1883, Fishe Japans, II, p. 10. – NYSTRÖM, Jap. Fisk saml., K. Svenska Vet. Akad., XIII, Afd. 4, No. 4, p. 9. – JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., XXIII, p. 353. – SMITH et POPE, 1907, Proc. U. S. Nat. Mus., XXXII, p. 475. – JORDAN et THOMPSON, 1912, Proc. U. S. Nat. Mus., XLI, no. 1875, p. 539. – TANAKA, 1913, Fish. Japan, pp. 367–370, pl. C, figs. 311–312. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. X, no. 2, pp. 237–238. – KAMOHARA, 1931, Zool. Mag., 43(508), p. 88. – OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, p. 196, fig. 127.

Pelates oxyrhynchus FOWLER, 1928, Mem. Bishop Mus., vol. 10, p. 213. – FOWLER, 1931, Bull. 100, Unit. Stat. Nat. Mus., vol. 11, pp. 363–364.



Text-fig. 110. ***Terapon oxyrhnchus*** TEMMINCK et SCHLEGEL.

The original description* is as follows:

Therapon oxyrhynchus

Cette espèce inédite, qui se distingue de toutes les autres connues par ses formes allongées, se rapproche sous plusieurs rapports de celle, que CUVIER range dans son sous-genre *Pélate*; elle lui ressemble aussi par sa physionomie. Supposant que ce sous-genre ne mérite quêre d'étre conservé, nous avons simplement fait de notre poisson un *Thérapon.* – Formes du tronc et de la tête allongées; museau pointu; aeil peu grand et reculé; mâchoires armées de dents nombreuses et très délicates, celles de la rangée extérieure un peu plus grandes que les autres; palais et vomer dépourvus de dents; sousorbitaire antérieur en forme d'écaille, dentelé sur le bord et recevant le maxillaire. Préopercule assez arrondi, à bord armé de dentelures tres fortes en guise d'épines; opercule muni d'une épine très forte, et d'une seconde, supérieure, assez courte; os surscapulaire et coracoide sortant de la peau en forme de lame dentelée. Dessus de la tête et museau nus. Écailles peu grandes, finement ciliées sur le bord. Dorsale allongée, peu échancrée, le permier rayon plus court que le deuxième qui n'atteint pas tout-à-fait la longueur du troisième; caudale large, à peine échancrée; pectorale petite; épines de l'anale

* TEMMINCK et SCHLEGEL, 1842, Faun. Poiss., Jap., p. 16, pl. VI, fig. 3.

fortes, le premier plus de moitié plusc ourt que le second. D. 12 + 10; A. 3 + 8. – Le corps est, à l'état frais, d'un bleu-verdâtre sale et pâle, qui passe en dessous à l'argentè, et qui est faiblement nuancé sur la tête de jaune et de rougeâtre. On voit sur les côtés du poisson quatre raies noirâtres, entre lesquelles se trouvent d'autres raies très peu visibles et souvent interrompues. Ces premières raies sont distribuées de la sorte que la supérieure longe le dos depuis le front jusqu'à la seconde dorsale; la deuxième raie passe au dessus de l'aeil et aboutit à la fin de la dorsale molle; la troisième passe sur l'aeil, depuis la pointe du museau jusqu'an centre de la caudale; l'inférieure commence derrière la pectorale et finit derrière l'anale. Ces raies, toutefois, sout souvent interrompues et composées de taches plus ou moins allongées. La dorsale, dont le fond est grisâtre, offre une raie foncée à sa base, avec plusicurs taches oblongues à sa partie molle; la partie épineuse est d'un brun-noir vers le bord de la membrane. La caudale, d'un brun-pâle, porte de nombreux traits longitudinaux d'un brun foncé. Les autres nageoires ont une teinte jaune, mais la partie molle de l'anale est nuancée d'une teinte plus foncée. – Ce poisson atteint une taille de neuf à dix pouces. Son nom japonais est Sima-isisaki. Sa chair est excellente. Il fréquente en été les baies du Japon méridional et se prend souvent à l'embouchure des fleuves, qu'il remonte même après les fortes pluies.

Description; Head 3, depth of body $3\,^{1}/_{10}$ in total length without caudal. Eye $4\,^{1}/_{3}$, interorbital 4, snout $2\,^{8}/_{9}$, preorbital width $4\,^{1}/_{3}$, maxillary 4, depth of caudal peduncle $2\,^{8}/_{9}$, first spine of dorsal $9\,^{1}/_{2}$, sixth spine $2\,^{1}/_{4}$, first spine of anal $4\,^{1}/_{3}$, second spine $2\,^{3}/_{5}$, third spine $2\,^{9}/_{9}$, in head. B. 6; D. XII, 10; A. III, 8; P. 2, 11, 1; V. 1, 5; C. 2, 1, 15, 1, 2. Transverse rows of scales when counted in the downward and backward direction above lateral line 65, but when counted in the downward and foward direction 74; number of scales in a transverse row between insertions of dorsal and anal fins when counted in the downward and backward direction $^{14}/_{27}$.

Body oblong-elongate, compressed; caudal peduncle moderately long, much compressed; dorsal and ventral outlines similarly and evenly arched, nape being a little elevated. Head rather small but moderately long, with straight and steep profile; eye lateral, high up; interorbital moderately broad, convex; snout rather long, pointed when viewed from side; nostrils two, subequal in size; anterior nostril with posterior flap; the posterior also with more or less elevated rim; maxillary slipping under preorbital sheath for most part of its length and scarcely reaching to front rim of eye. Mouth subhorizontal, lower jaw included; lips thin; teeth in jaws villiform, in two rows laterally but anteriorly in rather wide band; upper jaw has a row of six, rather small canines at anterior end; in lower jaw teeth in outer series a little larger than others; vomer, palatines, and tongue teethless; lower edge of preoprbital serrated; preopercle rounded, with strong teeth at angle, diminishing in size above, with rather fine serrae on lower limb; opercle with 2 flattened spines, of which the lower one is much larger but does not reach to edge of opercular flap; clavicle denticulated. Gill openings wide; the membranes continued forward, scarcely united, free from the isthmus; pseudobranchiae well developed; gills 4; a slit behind the fourth gill; gill rakers on first gill arch flattened, pointed, with rather weak serrae, 7 + 14 in number, the longest being $2\,^{1}/_{3}$ in eye diameter. Dorsal not deeply notched between spinous and soft portions, the spines heteracanthous, that is, alternating the one stronger on the right sides the other on the left; dorsal outline of spinous and soft portions convex; anal inserted beneath first ray of dorsal, second spine stronger and longer than the third, its soft part similar in form

to soft portion of dorsal; both dorsal and anal with scaly sheath, depressible in a deep groove; pectoral low down, rather short, with rounded margin, not reaching to tip of pectoral; ventral inserted behind lower end of base of pectoral, not reaching to vent; caudal emarginate. Scales small, ctenoid; cheeks and opercles scaled; occiput, interorbital, snout, preopercle, maxillary and chin naked; lateral line complete, high, concurrent with back, ending at base of caudal.

Color in formalin brownish, lighter beneath; 4, blackish brown, broad longitudinal stripes alternating with 3 fainter ones; the second stronger stripe continued on to posterior ryas of dorsal, dorsal with a broad dark stripe at base and at margin; a faint band on base of anal, ventral margin of the fin somewhat dusky; pectoral and ventral light dusky, tip of the latter darker; caudal with dark vermiculated patched which fuse more or less with patterns on body. (by SH. TANAKA).

Type locality: – Nagasaki.

Habits: The present species is rather common in the southern parts of middle Honsyu, dwelling in the entrance of river sometimes ascending into rivers. It makes a vocal sound by the contraction of air-bladder. It is carnivorous and breeds in summer. The black patterns on the lateral side of body change by the growth.

JORDAN et HUBBS[1] has noted that the young of this species live in the bays and estuaries, ascending streams. These, when about 5 or 6 cm. long, differ widely from the adult, as mentioned by JORDAN & THOMPSON.[2]

Distributions: Nagasaki (TEMMINCK & SCHLEGEL); Japan (BLEEKER); Tokyô (STEINDACHNER); Nagasaki; Shimoda (BLEEKER); Nagasaki (NYSTROM); Tokyô (JORDAN & SNYDER); Kôchi, Shikoku; Matsushima Bay, Miyagi Prefecture (SMITH & POPE); Shimizu, Shizuoka Prefecture; Wakanoura, Wakayama Prefecture; Kagoshima, Kyûshû; Nagasaki, Nagasaki Prefecture; Akune, Kagoshima Prefecture; Nogoya, ? Tokyô; Numazu, Shizuoka Prefecture (TANAKA); River Kachi, Nagoya (JORDAN); Toba market (JORDAN & YAMAMOTO); Mikawa Bay (ISHIKAWA); Miyazu, Lake Mikata, Fukui Prefecture (JORDAN & HUBBS); Kôchi fish market, Kôchi Prefecture (KAMOHARA); Kadzosa; Kôchi; Matsushima (Smith); Akune, Satsuma; Shimizu; Kagoshima; Nagasaki (FOWLER).

Suborder Gobiina

Characters: Body elongate or oblong. Eyes usually moderate, sometimes concealed, skin of head continuous with their covering. Teeth generally small, sometimes developed into large canines. Premaxillaries protractile. Opercle unarmed; preopercle unarmed or with short spine. Gill membranes more or less attached to isthmus, gill openings thus largely lateral. Gills 4, slit behind fourth. Pseudobranchiae present or absent. No phloric appendages. Vertebrae 25 to 34. Body naked or covered with cycloid or ctenoid scales. No lateral line. Dorsal separate or connected; spinous fin, when present, of 2 to 8 flexible spines. Anal like soft dorsal, with small feeble spine or none. Caudal

1) JORDAN & HUBBS, 1925, Mem. Carn. Mus., vol. X, no. 2, p. 237.
2) JORDAN & THOMPSON, 1912, Proc. U. S. Nat. Mus., XLI, p. 538.

convex. Ventrals thoracic or subjuglar, each of weak spine and 4 or 5 short rays.

Key to Japanese families of Gobiina

a[1] Pelvics entirely separate, ventrals separate.. **Eleotridae**
a[2] Pelvics fully united ventrals united, usually modified as adhesive disk or cup........... **Gobiina**

Family Eleotridae

Characters: Palatine with an ascending stem articulating directly with lateral ethmoid apophysis behind origin of maxillary process; mesopterygoid narrow, but well developed. Hypercoracoid and hypocoracoid well developed; radials inserted on hypercoracoid, hypocoracoid, and on ligamentous cartilagenous tissue between these bones. Vertebrae 25 to 28, of which 14 to 17 caudal. Ventral fin more or less completely separated, never forming disklike sucking organ.

Genus Eleotris Bloch et Schneider, 1801.

Eleotris Bloch et Schneider, 1801, Syst. Ichth., p. 65.

Type..............**Gobius pisonis** Gmelin

Characters: Body rather small, long and low, compressed behind. Head. long, low, flattened above, without spines or crests, almost everywhere scaly. Mouth moderate or large, oblique, lower jaw projecting. Lower pharyngeals rather broad, the teeth small, bluntish. Body covered with small scales; preopercle with a concealed spine; isthmus wide, gill openigs extending no farther forward than posterior angle of preopercle. Teeth weak, none on the vomer. Orbital rim adnate. Ventral rays, I, 5; soft borsal and anal similar. The dorsal fins separate, the first of a few week flexible spines, caudal more or less rounded, ventrals close together, not united. Cosmopolitan, many marine species in warm shore waters, some entering fresh water freely and others confined to freshwater.

Key to Japanese genera of Eleotridae.

a[1] One or more spines on posterior margin of pre-opercle.. **Eleotris**
a[2] No spines on head, without ossified ridge on upper of eye.............................**Mogurnda**

107. Eleotris oxycephala Temminck et Schlegel.

Sleeper, "Kawaanago"

(PL. LIV, figs, 1–9; Text-fig. 111).

Eleotris oxycephala Temminck et Schlegel, 1845. Fauna Japonica, Poiss., p. 149, pl. lxxvii, figs. 4, 5. - Günther, 1861, Cat. Fish., iii, p. 116. – Jordan et Snyder, 1900, Proc. U. S. Nat. Mus., p. 371. - Jordan et Snyder, 1901, Proc. U. S. Nat. Mus., vol. xxiv, no. 1244, pp. 46-47. – Jordan

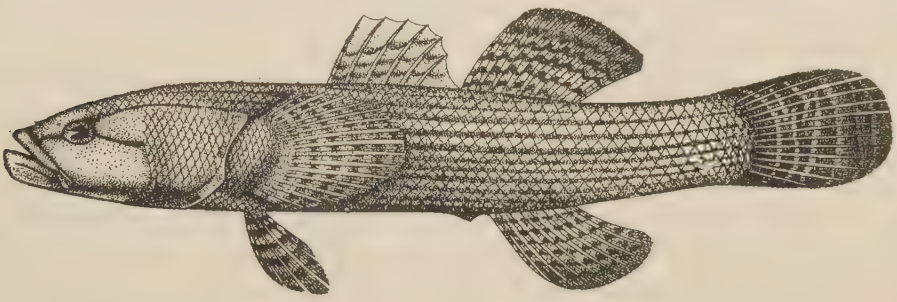
et RICHARDSON, 1909, Mem. Carn. Mus., vol. 4, no. 4, p. 200. - TANAKA, 1912, Fish. Jap., vol. x, p. 174, pl. 47, figs. 184-186. - JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Jap., p. 339. - JOADAN et HUBBS, 1925, Mem. Carn. Mus., p. 304. - KAMOHARA, 1931, Zool. Mag., 43 (508), p. 94. - UI, 1932, Kisyu Gyofu, pp. 241-242. - OKADA et IKEDA, 1938, Trans. Biog. Soc. Japan, Vol. 3, no. 1, p. 84, pl. VI, fig. 4. - NICHOLS, 1943, Freshwater Fishes China, p. 255. - KOUMAN, 1953, Fish. Indo-Aust. Arch., x, pp. 299-300. AOYAGI, 1957, gen. Notes Freshwat. fish., Jap. Arch., pp. 210-211. figs. 175.

Eleotris pisonis oxycephala TOMIYAMA, 1936, Gibid. Jap., pp. 41-42. - HARADA, 1943, Hainan Freshwater Fishes, p. 81, pl. XXVI, 100.

Eleotris contherinus RICHARDSON, 1846, Rep. Brit. Assoc. Adv. Sci., p. 209.

Eleotris balia JORDAN et SEALE, 1905, Proc. U. S. Nat. Mus., vol. 28, p. 526, fig. 6. - KOUMANS, 1940, Zool. Meded. Leiden, 22, p. 126.

Eleotris fortis TANAKA, 1912, Fish. Japa., vol. 6, p. 106, pl. 27, figs. 108, 109, pl. 28, fig. 113.



Text-fig. 111. ***Eleotris oxycephala*** T. et SCH. × 2/3 after SH. TANAKA.

The original description* is as follows:

Eleotris oxycophala Pl. LXXVII, fig. et 5.

Les mers du Japon produisent une deuxième espèce d' *Eléotris*, trèsdifférente de la précédente, ét, à ce qu'il parait, bequcoup plus rare, attendu que nous n'en avons recu que deux individus, et que Mr. BÜRGER n'en fait nullement mention dans ses notices qu'il nous a fait parvenir sur les poissons du Japon. Le plus grand de ces deux individus porte en longueur totale sept pouces et demi, l' autre n'est que de quatre pouces. Cette espèce offre des formes plus alongées que l'*Eleotris obscura*, as tête est alongée et plus étroite, l'intervalle des yeux est plus large, les yeux n'offrent point de bord saillant, et elle a toutes les nageoires ornées de nombreuses taches foncées disposées par bandes serreés.

La hauteur du corps de cette espèce est environ six fois et demie dans la longueur totale, dont la tête occupe la quatrième partie. Le museau étant assez court, il entre cinq fois dans la longueur de la tête; l'entre-deux des yeux est presque d'un tiers plus considerable que cette longueur du museau. Les yeux sont de grandeur moyenne, et en forme d'ovale disposé horizontalement. On remarque au devant de l'aeil une protubérance assez considérable. La bouche est fendue jusque sous l'aplomb du bord antérieur de l'aeil. Les mâchoires sont armées chacune d'une bande de petites dents en cardes, dont la largeur n'égale que la moitié du diamètre horixontal de l'aeil. Les côtés de la tête sont sillonnés de plusieurs lignes: la supérieure va en direction droite du bord postérieur de l'aeil au bord supérieur de l'opercule; la deuxième, en forme d'un S et naissant également sur ce bord de l'aeil, occupe la partie supérieure du préopercule; une troisième ligne, dont la direction est horizontale, se voit sur les parties inférieures du préopercule, et elle est réunie à l'aeil de à la ligne supérieure du

* TEMMINCK & SCHLEGEL, 1845, Faurna Japonica Poisson, p. 141.

préopercule, au moyen de quatre lignes verticales. Toute la tête est revêtue d'écailles, mais elles y sont beaucoup plus petites que sur le tronc. La ligne latérale parait manquer tout-à-fait. Les ventrales ne présentent rien de particulier. Les pectprales offrent une forme un peu alongée, et elles s'étendent jusque sous l'aplomb du dernier rayon de la dorsale épineuse. Cette nageoire commence au-dessus de la fin de la première moitié des pectorales. La deuxième dorsale nait au-dessus de l'anus, elle est plus élevée que la dorsale épineuse. L'anale ressemble par sa forme à la deuxième dosale. La caudale est arrondie à son dord postérieur. D. 6 et 9; A. 9; V. 5; P. 17; C. 16.

Conservé dans l'esprit de vin, ce poisson est d'un brun foncé, interrompu sur le tronc de lignes longitudinales claires, dont le nombre correspond au nombre des rangées d'əcailles. Le deseous de la tête est parsemé de petites taches claires. Les nageoires sont d'une teinte claire; mais elles offrent toutes de nombreuses bandes étroites, serrées et composées de petites taches d'un brun plus ou moins foncé.

Description: Head 2.9 in body length exclusive of caudal fin; depth 5.5. Eye 4.1 in head; snout 5.2; interorbital space 4.8; depth of caudal peduncle 3.1. D. VI, 8+1; A. I, 9. Scales in longitudinal series 52, in transverse 15.

Body elongate, subcylindrical, compressed; caudal peduncle greatly compressed. Head large, long, depressed, pointed. Snout short, rather sharp; the lower jaw projecting. Eyes very small, directed laterally; interorbital area flat; the distance between eyes $3^1/_2$ times their longitudinal diameter. Mouth very oblique, lower jaw longer; lips rather thin, Maxillary except its distal part concealed; reaching a vertical between pupil and posterior edge of orbit. Tongue broad; the anterior edge concave, free anteriorly, Teeth in jaws subequal, simple; in rather broad bands on jaws; no teeth on vomer or platines. Gill openings not extending very far forward; the width of isthmus equal to length of snout. Inner edge of shoulder girdle without elevations. Gill-rakers on first arch stumpy, 4+10; covered with setae; pseudobranchiae present. Posterior border of preopercle with a blunt spine which projects downward. Anterior nostril with a low tube. No barbels on lower jaw.

Head with scales, except on snout, throat, and chin; occiput and cheeks with small cycloid scales. Body with large ctenoid scales; those on nape, breast, and belly smaller; cycloid.

Dorsals separate; first dorsal inserted midway between tip of snout and depressed tip of second dorsal; the spines when depressed just reaching insertion of soft dorsal; posterior rays of soft dorsal longest; when depressed they reach base of caudal. Caudal rounded. Anal inserted a little behind origin of second dorsal; when depressed the rays do not quite reach base of caudal. Pectoral low down, acutely rounded; not reaching to tip of pectoral; the upper rays without filamentous tips. Ventrals separate; situated a little before second dorsal; pointed; anal papilla distrinct.

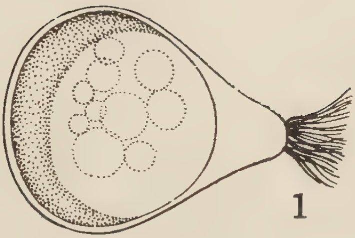
Color in formalin blackish brown, lighter beneath, but the back of head and body distinctly plain; with blackish wide longitudinal band running backward from the posterior edge of eye to the base of caudal fin; with diverging blackish streaks surround eye.

Scales with subdued, dark, lateral bands; a narrow brownish bend running obliquely downward from eye to edge of preopercle; a similar but shorter band above the latter extending directly backward. Spinous dorsal with two brownish linesrunning horizontally; soft dorsal with brownish, inverted. V-shaped marks on the membranes. Caudal

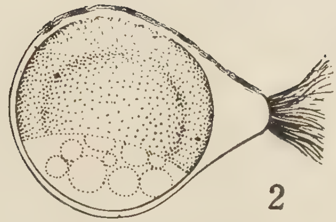
PLATE LIV

Development of ***Eleotris oxcephala*** TEMMINCK et SCHLEGEL, after Y. DOTU and SH. FUJITA (1959).

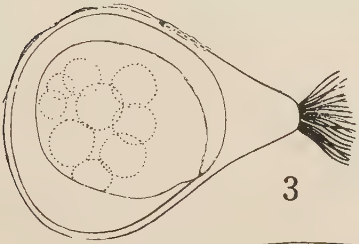
1. Developing Egg, blastula stage, 2°30' after spawning.
2. Egg, 3° after spawning.
3. Blastopore closed egg, 5°30' after spawning.
4. Early embryo with 7 myotomes and Kupffer's vesicle' 7°20' after spawning.
5. Newly hatched larva,. 1. 0 mm. in total length.
6. Larva, 1. 3 mm. in size, 15° after hatching.
7. Larva, 1. 7 mm. in size, 36° after hatching.
8. Larva, 2. 0 mm. in size, 84° after hatching.
9. Juvenile 13. 0 mm. in size.



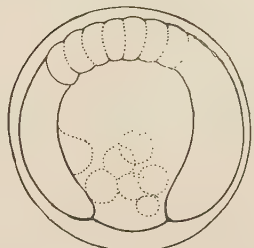
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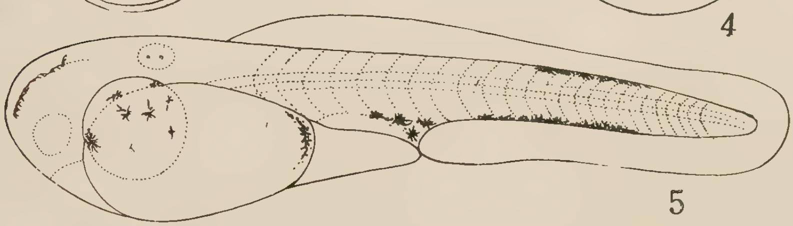
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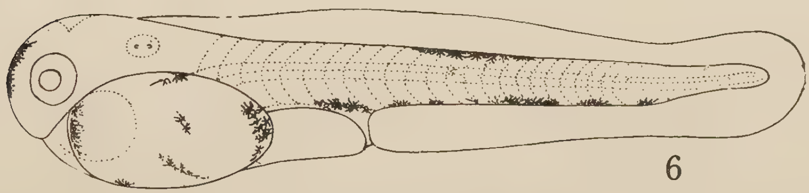
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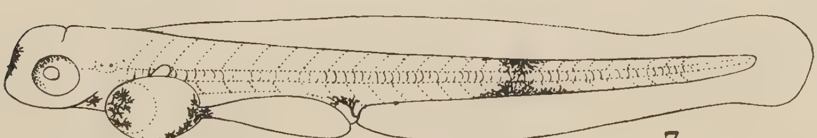
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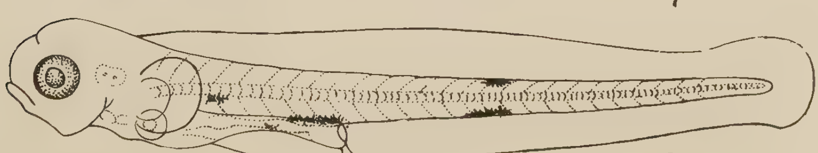
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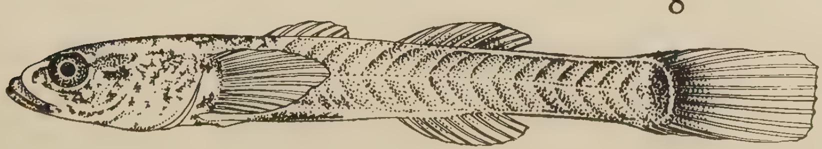
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7



8



9

and pectorals with small brownish spots arranged in wavy lines. Anal with indistinct dark markings.

The fish are distributed in the freshwater of the lower stream of the middle river end in the brakish water and lake to live in muddy bottom of the steady current waters. The food is consisting of freshwater shells and worms.

Type locality – Nagasaki.

Distribution: Hainan (OSHIMA); Canton (NICHOLS); Kôchi Prefecture south to Formosa; East Indies; South China (TOMIYAMA); Wakayama Prefecture (UI); Yokohama; Haneda; Wakayama; Lake Biwa (JORDAN & SNYDER); Yokohama (JORDAN); & SNYDER); Kera, Kôchi (TANAKA); Tôkyô to Nagasaki (JORDAN, TANAKA & SNYDER Kumamoto, Kyûsyû (JORDAN & HUBBS); Kôchi Fishmarket, Kôchi Prefecture (KAMOHARA); Takao, Formosa (JORDAN & RICHARDSON); River Chikugo; River Yabe, Kumamoto Prefecture (AOYAGI); Kagoshima Prefecture (OGAWA); Miyazaki Prefecture (AOYAGI); Lake Biwa (TANAKA); River Kiso (NIWA): River Miyakoda; Tenryû River, Shizuoka Prefecture (OKANO & TOMIYAMA); Yokohama (JORDAN & SNYDER); River Watarase, Ibaraki Prefecture (TANAKA, TOMIYAMA-Northern limit), River Yahagi, Aichi Prefecture (UMEMURA); Okayama Prefecture (OSHIMA).

Remarks: TOMIYAMA distinguished three forms *Eleotris pisonis oxycephala oxycephala. E. pisonis oxycephala tanakae* from Kôchi Prefecture, south to Formosa. The last one may be similar to *E. fortis* TANAKA.

Genus **Mogurnda** GILL, 1863.

GILL, 1863, Proc. Ac. Nat. Sci. Philadelphia, p. 270.

Type ....**Krefftius** OGILBY, Proc. Linn. Soc. N. S. Wales 21, 1897, p. 736.

Characters: Body elongate, compressed, covered with 30–40 ctenoid scales. Head large and broard, scaled in front to posterior nostrils, on cheek and opercle. Mouth moderate, oblique, lower jaw prominent. Teeth in several rows. Tongue rounded. Gill openings a little continued forward below, isthmus moderate. Dorsal fins separate. First dorsal fin with 7–9 rays. D. 2 I. 8–14; A. I. 8–15. Caudal fin rounded.

108. **Mogurnda obscura** (TEMMINCK et SCHLEGEL).
"Kawasuzuki, Donko"
(Text-figs. 112, a–b)

Eleotris obscura TEMMINCK et SCHLEGEL, 1848, Fauna Japonica, Poiss., p. 149, pl. 77, figs. 1-3. – GÜNTHER, 1861, Cat. Fishes, III, p. 115. – ISHIKAWA, 1897, Prel. Cat. Fish. Imp. Mus., p. 37.

Eleotris potamophila GÜNTHER, 1861, Cat. Fishes, III, p. 557.

Odontobutis obscura JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., p. 371. – JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. XXIV, no. 1244, pp. 43-44. – JORDAN et THOMPSON, 1914, Mem.

Carn. Mus., vol. vi, no. 4, p. 286. - Chu, 1932, Fish. West Lake, pp. 54-56, figs. 38, 39. - Ui, 1932, Kisyu Gyofu, p. 241. - Miyadi, 135, Kyôtofuka no Tansuigyo, p. 42. - Jordan et Hubbs, 1925, Mem. Carn. Mus, Vol. x, no. 2, p. 304. - Harry, 1948, Proc. Calif. Zool. Club, i, no. 3, figs. 5, 6. - Kouman, 1954, Fish. Indo-Aust. Arch., x, pp. 302-304.

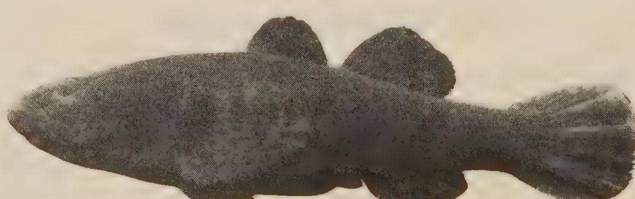
Odontobutis obscurus Okada, Uchida et Matsubara, 1935, Nihon Gyorui Zusetsu, p. 227, pl. 132, fig. 2.

Mogurnda obscura 1905, Jordan et Seale, Proc. U. S. Nat. Mus., vol. xxix, no. 1433, p. 526. - Tanaka, 1912, Fish. Japan, pp. 130-133, pl. xxxv, figs. 134, 135, 136. - Jordan, Tanaka et Snyder, 1913, Cat. Fish. Japan, p. 339. - Kamohara, 1931, Zool. Mag., 43 (508), 94. - Okada et Nakamura 1948, Nihon Tansuigyorùi, pp. 200-201, fig. 133. Aoyagi, 1957. Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 214-216, Figs. 179-180.

The original description*is as follows:

Eleotris obscura Pl. lxxvii, fig. 1, 2, 3.

Les différentes espèces du genre *Eléotris* offrant souvent une grande affinité entre elles, il est presque impossible de lesdistinguer au moyen d'une simple description. Pour remédier à cet inconvénient, il est essentiel de publier des figures exactes de ces animaux, ou de représenter du moins avec exactitude la tête des différentes espèces; car c'est dans cette partie que résident les caractères essentiels des différentes espèces de ce genre. Nous avons suivi cette méthode par rapport aux *Eléotris* du Japon, contée qui produit deux espèces appartenant à ce genre, et qui paraissent se distinguer de toutes celles décrites jusqu'a présent. Ces deux espèces du Japon sont du nombre de celles qui ont le corps pourvu de grandes écailles. La première de ces espèces, notre *Eleotris obscura*, se sitingue facilement par sa dorsale composée de sept et non pas de six rayons, comme cela a lieu ordinairement. Elle convient sous ce rapport à l'*Eleotris tumifrons* de Cuvier et Valenciennes, l. c, XII, p. 241; mais elle se distingue au premier aspèct de cette espèce, par son front plane et par conséquent nullement bombé, ce



a



b

Text-figs. 112. a. ***Mogurnda obscura*** Temminck et Schlegel, after M. Nakamura.
b. ***Mogurnda obscura*** Temminck et Schlegel, after Sh. Tanaka ×1.5

*Temminck et Schlegel, 1848, Fauna Japonica Poissons, p. 149.

qui est le caractère essentiel de l'*Eleotris tumifrons*. Les formes du corps n'offrent rien de particulier. La hauteur du tronc est environ cinq fois dans la longueur totale du poisson; la tête n'entre dans cette longueur que trois fois et un quart; le museau est un peu plus de quatre fois dans la tête; l'intervalle des yeux, enfin, ágale la longueur de la tête. Les yeux sont peu volumineux, et tréspeu dirigés vers le haut; ils sont entourés d'un bord saillant, assez large notamment vers le haut, et revêtu, ainsi que le museau, d'une peau parfaitement lisse. La partie du front comprise entre ces bords, est plane et revêtue d'écailles comme les autres parties de la tête en arrière du museau. La bouche, dirigée obliquement vers le haut, est fendue jusque sous l'aplomb du boud antérieur de l'aeil; et la mâchoire inférieure dépasse notablement la supérieure. Toutes les deux sont armées de nombreuses dents passablement longues, aiguës, cour bées un peu vers le derrière, et distribuées sur une bande dont la largeur égalesur le devant de la bouche le diamètre de l'aeil. On remarque sur la tête plusieurs lignes plus on moins flexueuses; l'une d'entre elle entoure le bord saillant de l'aeil et se prolonge jusque sur la lèvre supérieure; elle donne naissance à sa partie inférieue à quatre autres lignes horizontales, dont les trois premières se distribuent sur le préopercule, tandis que la quatrieme va du bord postérieur de l'orbite vers l'extremite supérieure de la fente des ouies. Les ventrales et les pectorales ne présentent rien de particulier. Les deux dorsales sont assez rapproches l'une de l'autre, et leur étendue n'occupe que deux septièmes de la longueur totale du poisson; elles sont placées exactement au milieu de l'espace compris entre les extrémités du museau et de la nageoire caudale. La dorsale épineuse, composée de sept rayons, est arrondie, mais plus basse par derrière que par devant. La dorsale moolle, un peu plus longue que l'épineuse, est aussi plus haute; sa hauteur egale le diamètre de la queue près de la fin del'anale; sa forme est assez arrondie. La caudale est large et également arrondie. L'anale commence sous l'aplomb du cinquième rayon de la dorsale molle, qu'elle égale par son étendue; mais elle est d,un quart moins élevée et pointue par derrière, quoique arrondie dans le reste de son pourtor. Les écailles sont de grandeur moyenne, et on ne remarque aucune trace de la ligne ligne latérale. D.7 et 9ou 10; A. 8 ou 9; V. 5; P. 15; C 1. 5.

La teinte dominante est un brun sale, très-foncé sur le dessus du corps, très- pâle sur les parties inférieures. Cette teinte est irrégulièrement nuagée de brun noirâtre, qui forme des raches pqu grandes et, distribuées par bandes sur les dorsales, la caudale et les pectorales; on compte cinq de ces bandes sur ces dernières nageoires. Les ventrales et l'anale tirent au gris foncé. II en est de même du dessous de la tête qui est ordinairement ornée dans les jeunes infividus de traits jaunâtres. L'iris de l'aeil est d'un bleu grisâtre sale.

Ce poisson parvient à une taille d'un pied; son nom japonais est *Kawasuzuki*; tous nos individus ont été pris dans les rivières qui se jettent dans la baie de Nagasaki. On le prend le plus souvent en été, natamment lors des jours pluvieur.

Description: Head in length 2.7 to 2.8, depth 3.7 to 4.0. Eye in head 6 to 6.4, snout 4.3 to 4.6, interorbital 4.6 to 4.7. width of head 1.4 to 1.5, width of mouth 2.1 to 2.4, depth of caudal peduncle 3 to 3.2.

Body oblong, stout, subcylindrical anteriorly; caudal peduncle rather deep, not much compressed, its depth about 3 in head; head large, depressed, somewhat broader than the body, but less deep; abdomen broad, rounded. Interorbital space gently concave, broad, equal length of snout; snout long, pointed; the lower jaw projecting beyond the upper; nostrils separated, but close together in front of eye, the posterior a small opening, the anterior with a low tube. Eye small, protruded, directed almost laterally with-

out fiee orbital margin. Mouth wide, oblique; lips broad; maxillary concealed by lip; reaching to below pupil of eye; lower jaw prominent; teeth in jaws small, simple, short, crowded in broad bands on jaws, none on vomer or platines; tongue very broad, truncate, or slightly notched at the middle of tip. Scales covering entire body and head except snout, lips and chin; those on dorsal and lateral surfaces ctenoid, those on the ventral surface and on the base of pectorals cycloid; 28–29 scales each with a vertical row of small sensory bulb-like organs, similar to but larger than those on the scales just referred to. The principal grooves are as follows: 1 above eye from tip snont to hind border of eye, 1 below eye extending backward to upper corner of opercle, 1 along edge of preopercle extending forward and ventrad to end of the chin, 2 or more on the cheek. Besides grooves, there are semicircular depressions in which are likeweise developed groups of sensory buds. Gill opening very large, extending far forward; branchiostegals five in numbers. Gill-rakers on first arch 3 + 6 low, rounded, beset with fine teeth, about

Table 114. Measurements of *Mogurnda obscura* TEMMINCK et SCHLEGEL*

	Chikugo River, Kurume, Kyûshû			Tôkyô	
Body length	114. 0mm.	102. 0mm.	82. 0mm.	133. 0mm.	123. 0mm.
Depth of body	26. 0	24. 0	28. 0	26. 0	27. 0
Depth of caudal peduncle	14. 0	14. 0	14. 8	12. 5	13. 0
Length of head	36. 0	35. 0	35. 0	35. 0	35. 0
Length of snout	11. 0	10. 0	10. 0	11. 5	12. 5
Length of maxillary	15. 0	15. 0	16. 0	16. 0	15. 0
Width of interorbital space	8. 0	9. 0	8. 0	8. 0	9. 5
Diameter of orbit	6. 0	5. 5	7. 0	5. 0	5. 5
Distance from snout to spinous dorsal	46. 5	45	46	46. 0	46. 0
Distance from snout to soft dorsal	62. 5	63, 5	64. 0	64. 0	64. 0
Height of longest dorsal spines	11. 5	12. 0	11. 5	14. 0	13. 0
Height of longest dorsal rays	15. 0	14. 0	15. 5	15. 0	14. 0
Distance from snout to anal fin	69. 5	67. 0	67. 0	71. 5	70. 0
Height of longest anal rays	11. 5	14. 5	15. 5	14. 5	15. 0
Length of caudal peduncle	23. 5	23. 0	23. 0	22. 0	22. 0
Length of caudal fin	26. 0	25. 0	26. 0	22. 5	23. 0
Length of pectoral fin	24. 0	25. 0	24. 5	21. 5	23. 0
Length of ventral fin	17. 0	18. 5	19. 0	16. 5	15. 5
Number of dorsal spines	7. 0	7. 0	7. 0	8. 0	7. 0
Number of dorsal rays	10. 0	9. 0	9. 0	10. 0	9. 0
Number of anal rays	8. 0	9. 0	8. 0	8. 0	8. 0
Number of scales in lateral series	35. 0	36. 0	34. 0	34. 0	32. 0
Number of scales iu transverse series	17. 0	16. 0	17. 0	14. 0	15. 0

* These measurements were made by JORDAN & SNYDER.

10 in the first arch.

Dorsal well separated into two; the first dorsal short with 6–7 weak spines; the second with 9–10 soft rays. Anal with 8–9 soft rays; origin opposite to or slightly in front of the midled of the base of 2nd dorsa.l Ventrals separated at their base by a distance about equal to two-thirds the diameter of eye. Pectorals acutely rounded; with 14 soft rays, upper edge without filaments. Caudal rounded. Anal papilla triangular and point-

ed in males, tubular and blunt in females.

Body with much dark brownish or blackish; in blotches of irregular shape; several broad, rather with 7 or 8 indistinct, narrow lateral bands on the side. Under part of head with large, light spots. Soft dorsal, anal, caudal and pectorals crossed by rows of dusky spots. Base of pectoral usually with 2 dark spots. Dark spots in ventrals either arranged in imperfect rows or more or less fused into an irregular blotch.

The male is less in number than the female. The fish live in the lower stream of the middle river and sometimes in the brakishwater. They are solitary in life on the muddy or sandy bottom and omniborous. The food is consisting of small fish, crustaceans and aquatic insects.

Type locality: Rivers flowing to Nagasaki.

Distribution: Wakayama Prefecture (UI); Kagoshima Prefecture north to Toyama Prefecture and Akita Prefecture (TOMIYAMA); Lake Biwa; Maibara; Matsubara; Hikone; Yamashiro; Yamato; Tsuyama (JORDAN & SNYDER); Yokohama (JORDAN & SNYDER); River Chikugo, Kurume; Tôkyô Bay; Lake Biwa (UNAKI): River Chikugo, at Kurume and Kawatana, on the Bay of Ômura (JORDAN & SNYDER); Tôkyô to Nagaksai (JORDAN, TANAKA & SNYDER); Lake Biwa, Matsubara; Okayama (JORDAN & THOMPSON); Kumamoto; Ôzu, Shiga Prefecture; Hamada, Shimane Prefecture (WAKIYA); Himeji, Hyogo Prefecture (ABE); Kôchi fish market, Kôchi Prefecture (KAMOHARA); Yokohama (OTAKI); Kagoshima Prefecture (TOMIYAMA & KOYAMA); Akamanuma, Tochigi Prefecture (AOYAGI-Northern limit); Toyama Prefecture (TOMIYAMA); Tone River, Ibaraki Prefecture (AOYAGI); Lake Yogo, Shiga Prefecture (JORDAN & FOWLER); River Aikawa, Tsu, Mie Prefecture (OKADA & KUBOTA); River Yahagi, Aichi Prefecture (HASUMOTO); River Midori, Kumamoto Prefecture (KOBA); River Yoshino, Okayama Prefecture (OSHIMA).

Remarks: The present species is distributed far south the middle Honshû and Kyûshû, except the northern part of Japan. It is dwelling in rivers, lakes and swamps, and feeding on small fishes, as well as microanimals. The female deposits egg on stones during June.

Family Gobiidae

Characters: Body oblong or elongate, compressed at least posteriorly, naked or covered with ctenoid or cycloid scales. Head often more or less depressed; premaxillaries protractile; suborbital without bony stay. Skin of head continuous with covering of eyes. Eyes usually moderate, sometimes concealed. Opercle unarmed; preopercle unarmed, or with a short spine; pseudobranchiae present or absent. Gills 4, a slit behind the fourth; gill membranes more or less united to the isthmus, the gill openings

thus restricted to the sides. No lateral line. Dorsal fins two, separate or connnected, the spinous dorsal short, of 2 to 8 flexible spines, or sometimes wanting; anal usually with a single weak spine, the fin similar to soft dorsal; ventral fins united forming a sucking disk, free from abdomen a cross fold of skin at their base completing the cup; caudal fin convex; anal papilla prominent. No pyloric caeca; usually no air bladder.

Key to the Japanese Subfamilies of Gobiidae

a1 Body elongate, long; outer most tooth of both jaws tricuspid........................**Tridentigerinae**
a2 Body elongate, teeth of lower jaw simple .... **Gobiinae**

Subfamily Tridentigerinae

Characters: Body elongate, with ctenoid scale; the outer most tooth of both jaws tricuspid; the central larger than the lateral. Dorsal fin separated. Base of second dorsal and anal fins short. Left and right ventral fins united at the base and anteriorly free from belly.

Genus Tridentiger Gill, 1858.

Tridentiger Gill, 1858, Ann.. Lyc. Nat. Hist. N.Y., p. 16.
Type: - **Sicydium obscurum** Temminck et Schlegel

Characters: Body robust, little compressed, covered with moderate or rather large ctenoid scales; head broad, little depressed above, the eyes well separate, the cheeks tumid, scaleless; mouth moderate, oblique, the lower jaw rather prominent, teeth rather large, fixed, in about 2 rows; those in the outer row trifid, the middle cusp the longer; inner series of smaller pointed teeth; tongue rounded at tip; no barbels; gill openings restricted to the side, the gill openings very broad. Dorsals short, the first of 6 slender spines, the second of 10 to 12 rays; caudal rounded; pectoral rounded, some of the upper rays short, none of them silky. Ventrals rather long, not adnate to the belly.

109. Tridentiger obscurus (Temminck et Schlegel).
"Chichibu"
(PL. LV, figs. 1–8)

Sicydium obscurum Temminck et Schlegel, 1845, Faun. Jap., Poiss., p. 145, pl. 76, fig. 1.
Tridentiger obscurus, Gill, 1858, Ann. Lyc. Nat. Hist. N. Y. - Günther, 1861, Cat. Fish., iii, p. 566. Steindachner, 1879, Ichth. Beitr., viii, p. 29. - Jordan et Snyder, 1900, Proc. U. S. Nat. Mus., vol. xxiv, no. 1244, pp. 113–115. - Jordan et Thompson, 1914, Mem. Carn. Mus., vol. vi, no. 4, p. 290. - Jordan, Tanaka et Snyder, 1913, Cat. Fish. Jap., p. 359. - Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 309. - Kamohara, 1931, Zool. Mag., 34 (508), p. 94. - Ui, 1932, Kishugyofu, p. 244. - Miyadi, 1935, Kyotofuka Tansuigyo, p. 45, pl. 5, figs. 44, 44a. - Okada, Uchida et Matsubara, 1935, Nihon Gyorui Zusetsu, p. 231, pl. 136, fig. 1. - Tomiyama, 1936, Jap.

Journ. Zool., vol. VII, no. 1, p. 96. – OKADA et IKEDA, 1938, Sci. Rep. Tôkyô Bun. Daig., sect. B. no. 55, p. 154. – OKADA et IKEDA, 1938, Saitô Hô-onkai Mus., Resear. Bull., no. 15, p. 119. – OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, pp. 206-207, fig. 142.-AOYAGI, 1958, Gen. Notes Freshwat. Fish. Jap. Arch., pp. 243-245, figs. 196-198.

Odontobius obscurus TANAKA, 1908, Ann. Zool. Jap., vol. VII, pt. 1, p.10.

Triaenophorichthys squamistrigatus HILGENDORF, 1879, Sitzber. Naturf. Freunde, p. 111. – JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., p. 372.

Tridentiger squamistrigatus STEINDACHNER, 1879, Ichth. Beitr., VIII, p.31.

Tridentiger Kuroiwae JORDAN et TANAKA, 1927, d. 276, pl. 23, figs. 1-3.

Gobius (Ctenogobius) articeps REGAN, 1905, p. 364.

The original description* is as follows.

Sicydium obscurum Pl. LXXVI, fig. 1.

M. M. CUVIER et VALENCIENNES, en établissant le genre *Sicydium*, y ont rangé quatre espèces, l'une originaire des Antilles, deux autes des iles de France et de Bourbon, et la quatrième de Célèbes. Outre les *Sicydiums* que nous ont fourni les iles de Java et de Bornéo, il en existe un au Japon, qui parait diffèrer de toutes les autres espéces. Ce *Sicydium* du Japon se rapproche sous plusieurs rapports du *Sicydium laticeps* de l'ile de Bourbon; mais il s'en distingue par son museau moins carré et plus arrondi, par les quatre premiers rayons de sa dorsale epineuse prolongés, et par sa caudale qui pas bordée de blanc.

Ce *Sicydium* du Japon est ordinairement d'une taille de quatre pouces. La hauteur du corps entre six fois et demie dans cette longueur; la tête y est quatre fois et un tiers, et le museau entre trois fois et un quart dans la tête. L'entre-deux des yeux est à peu près égal à la longueur du museau. L'aeil est peu volumineux et rapproché du sommet de la tête qui est plane. Le museau, au contraire, est bombé et arrondi de rous côtés. On voit, suseau, à une petite distance de la lèvre supérieure, un petit bourrelet percé d'un trou, et derrière ce bourrelet, au milieu de l' espace compris entre l'aeil et la lèvre, une fente en croissant. La bouche est fendue jusque sous l'aplomb du bord anérieur de l'aeil. Il y a dans chaque mâchoire une bande très-étroite de petites dents; mais celles de la rangee extérieure sont, notamment à la mâchoire inférieure, passablement gandes, aiguës et très-serrées. Les pectorales sont de moyenne grandeur et en forme de caeur. La ventrale est comme à l'ordinaire petite; elle commence sous l'aplomb de la base des pectorales. L'anus s'ouvre un peu plus près du museau que de la fin de la caudae. La première dorsal est composée de six rayons flexibles et tous prolongés en filet; les deuxième, troisième et quatrième rayons surpassent de moitié le diamètre du coups aux pectorales; les autres rayons égalent ce diamètre. La deuxième dorsale est un peu plus haute que le diamètre du lobe libre de la queue. L'anale répond par sa forme et sa position à cette seconde dorsale, mais elle est un peu plus courte et d'un tiers plus basse. La caudale est assez développée, large et tant soit peu pointue. Les écailles sont de grandeur moyenne. Je n' ai pu découvrir aucune trace de la ligne latérale. D6. et 11; A. 10 a 11; V. 10; P. 16; C. 16.

Ce poisson est, à l' état frais, d'un brun foncé pointillé de brun noirâte. Le centre passe au bleuâtre. La membrane qui réunit ls ventrales est bordée de rouge couleur de sang. L'anale est plus pâle que les autres parties et tire un peu au jaunâtre vers le bas. Les individus conservés dans l'esprit de vin sont d'un brun uniforme, et on voit à la base des pectorales une bande blanchâtre assez large.

On appelle ce poisson au Japon Kawamotsiguuo. Il est commun dans les rivières dans les environs de Nagasaki. On le prend particulierement en été, lors des jouvieux.

Description: Head 3.5 in length; depth 4.5; depth of caudal peduncle 2.3 in head; eye 5.5 snout 3.3; D. VI-12; A. 11; P. 20; scales in lateral series 34, transveres series 16.

*TEMMINCK et SCHLEGEL, 1845, Faun. Jap. Poiss., p. 145, pl. LXXVI, fig. 1.

Head large and broad, the cheek muscles not so greatly developed as in *T. bucco*. Snout blunt; the jaws equal; mouth oblique. Maxillary reaching a vertical passing between pupil and anterior edge of orbit. Teeth in 2 series, those of the outer series in 2 closely apposed rows, the teeth alternating in position, flat, trilobed, except 2 or 3 posterior ones on each side of jaw; teeth of inner row small, simple, curved backward. Tongue broad, rounded anteriorly. Gill opening not extending far forward, the isthmus broad, its width equal to distance from pupil to tip of snout. Inner edge of shoulder girdle with a narrow, elevated ridge; but no papillae. Gill-rakers 3 + 12, rather short and blunt. Head naked, without barbels; anterior nostril with a high tube. Body with large, ctenoid scales; those anterior to dorsal and pectorals and on belly small and smooth; those on breast anterior to ventrals minute, embedded in th skin.

Dorsals separate; the spines long and filamentous, those of the females much shorter. Anal inserted below third of fourth dorsal ray, when depressed extending as far posteriorly as the dorsal, neither quite reaching the caudal. Caudal fin rounded. Pectoral without filaments on its upper border. Ventrals of moderate size; free posteriorly.

Color and pattern in formalin generally grayish, belly paller, with several streaks which run along the body; cheek and opercle with whitish pits; dorsal with some oblique grayish streaks, other fins all dusky, second dorsal and anal marginally with a white streaks pectoral basally with a white transverse band and one blackish blotch at the upper corner of its base.

Type locality: rivers in the bay of Nagasaki.

Habits: The present species is mostly dwelling in bay and shallow water of streams

Table 115. Measurements of *Tridentiger obscurus* (TEMMINCK et SCHLEGEL).

	Ishikawa Prefecture	Nagasaki Prefecture	
Body length	80mm.	66mm.	55mm.
Depth expressed in hundredths of length	26	21	24
Depth of Caudal peduncle	13	13	12.5
Length of Head	30	30	31
Length of Snout	10	9	11
Width of Interorbital space	4.5	5.5	4.2
Diameter of Orbit	4	4.5	5
Distance from Snout to spinous dorsal	41	42	40
Distance from Snout soft dorsal	61	60	60
Height of longest Dorsal spines	23	18.5	28
Height of longest Dorsal rays	16.5	14	16
Distance from Snout to anal fin	65	66	65
Height of longest Anal rays	15	14	14
Length of Caudal peduncle	22	24	22
Length of Caudal fin	21.5	22	22
Length of Pectoral fin	23.5	25	24
Length of Ventral fin	16	16	18
Number of Dorsal spines	6	6	6
Number of Dorsal rays	11	12	12
Number of Anal rays	11	11	11
Number of Pectoral rays	20	21	20
Number of Scales in lateral series	34	37	33
Number of Scales in transverse series	15	16	17

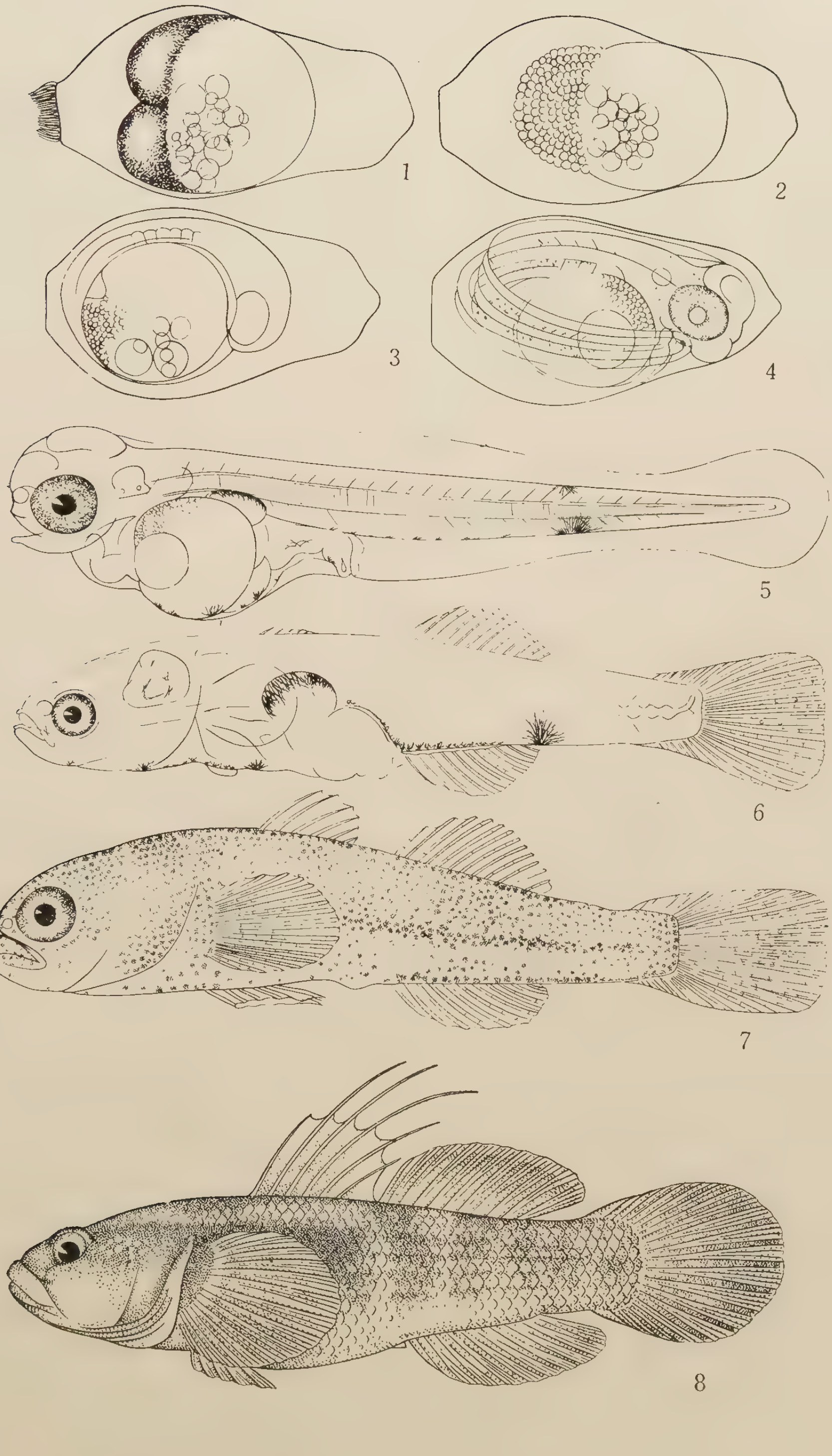
*These measurements were made by JORDAN et SNYDER for the specimens collected at Ishikawa and Nagasaki Prefectures.

PLATE LV

Development of ***Tridentiger obscura*** (TEMMINCK et SCHLEGEL), after N. NAKAMURA (1942).

1. Two celll stage.
2. Morula stage, 3° after spawning.
3. Early embryo with optic vesicle and 6 myotomes, 20° after spawning.
4. Embryo with anlage of pectoral fin and melanophores on optic vesicle, 80° after spawning.
5. Newly hatched larva, 3. 27 mm. in total length.
6. Juvenile, 9. 48 mm. in total length.
7. Juvenile, 11. 52 mm. in total length.
8. Adult.

PLATE LV



and feeding on small fishes, aquatic insects and pelagic crustacians. The breeding season occurs during April and August. The eggs are deposited under flat stones or wooden brocks, showing pear-like shape, measured $0.7 \times 1.2 - 1.4$ mm. The male protects eggs after the female spawned.

NAKAROKU NAKAMURA*, described the life history of *Tridentiger obscurus* (T. et SCH.) in 1942. The spawning season occurs in different seasons of under locations, in Tosa, Kôchi Prefecture, Shikoku, February to March; in Yamanashi, Nagano Prefecture (May to June); Kasumigaura, Ibaraki Prefecture (May to August) Ikawazu, Aichi Prefecture (April to September). Eggs are pear-shaped with many filaments at anterior end for attachment measuring 1.20–1.4 mm. × 0.65–0.75 mm., 0.22–0.26 mm. Yolk colorless, somewhat light yellow in advanced stage, with about 20 oil globules. They are deposited under flat stones or sometimes on concrete wall of fish culture pond or on the surface of wooden sluice. Number of eggs deposited in fish culture pond arranged from 4650–9740. The development is carried out under the water temperature of 18–22.5°C, as follows. lst segmentation (within 1 hour); morula stage (3 hours after fertilization).

Embryo with eye vesicale, and 6–7 myomeres (20 hours); embryo movable, with 17–18 myomeres; heart beating, light yellow or brown pigments on head and tail (2 days); melanophores on eye, tail developed, curved at the base of yolk sac, reaching the middle of yolk sac at its end (3 days); pectoral fin appears (4 days); air bladder appears (5 days); melanophores developed on eye, dorsal side of air bladder, on the middle of caudal (7 days); hatching out (about 10 days).

Distribution: Nagasaki (TEMMINCK & SCHLEGEL); Amami-Oshima; Yakushima; Okinawa; Ishigakijima (JORDAN & TANAKA); Inland Sea of Japan (REGAN); Hakodate south to Yaegakijima, Ryûkyû (TOMIYAMA); Shimoda, Shizuoka Prefecture (GILL); Tôkyô (HILGENDORF); Yokohama (JORDAN & SNYDER); Japan (STEINDACHNER); Enoshima; Tsuruga; Aomori; Matsushima; Kawatana; Kôbe; Kurume; Nagasaki; Misaki; Wakanoura; Same; Niigata; River Tone; Ise; Ishikawa Prefecture (JORDAN & SNYDER); Lake Abashiri, Hokkaidô (OKADA & IKEDA); River Iwaki, Hirosaki, Aomori Prefecture; Zyanoshima, Morioka, Iwate Prefecture; Naga-numa, Tome-gun, Miyagi Prefecture; Izunuma, Kurihara-gun, Miyagi Prefecture; River Hirose, Sendai, Miyagi Prefecture; River Uchi, Tsuruoka, Yamagata Prefecture; Tsuruoka, River Yuga, Yamagata Prefecture (OKADA & IKEDA); Nagoya (JORDAN & THOMPSON); Lake Tôgô, Tottori (INOMATA); Kumamoto (WAKIYA); River Kachi (JORDAN); Toba (JORDAN & YAMAMOTO); Mikawa Bay (ISHIKAWA); Himeji (ABE): River Tonda, Kisyû (KUROIWA); Aomori (BEPPU): Lake Biwa (JORDAN); Morioka, Rikuchiu (AWAYA); Noo, Niigata Prefecture; Lake Mikata, Fukui Prefecture (JORDAN & HUBBS); Kyôtofu (MIYADI): Aomori to Nagasaki (JORDAN, TANAKA & SNYDER); Misaki, Kanagawa Prefecture (JORDAN & THOMPSON); Kochi fishmarket, Kochi Prefecture (KAMOHARA); Kihama, Momose, Lake Biwa, Shiga Prefecture (TANAKA); River Ishikari, Hokkaidô (SOEDA); Abashiri Kake,

*NAKAMURA, N. 1942: Botany and Zoology, vol. 10, no. 1, pp. 7–11, figs. 1–3.

Hokkaidô (Okada & Aoyagi); River Tama, Tachikawa, Tôkyô (Jordan & Fowler); River Yahagi, Aichi Prefecture (Umemura); Around Tsu City, Mie Prefecture (Okada & Kubota); Mano, Sado; Kawarada, Sado (Oshima).

Subfamily Gobiinae

Characters: Body oval or elongate; scaleless on interorbital space and anterior head. Tooth simple, without indentation at end. Tooth of upper jaw one or few rows, tooth of lower jaw two or few rows. Base of the second dorsal longer than that of the first dorsal, sometimes without the first dorsal. Both of ventral or partly united to from sucker, attached to belly with base. Branchial apertures pretty large or broad.

Key to the Japanese Genera of Gobiinae

a1 First dorsal well-developed, 6–12 spines.
 b1 First dorsal with 6 spines .... **Rhinogobius**
 b2 First dorsal with 7 or more spines
  c1 Tongue rounded without indentation at anterior margin .... **Acanthogobius**
  c2 Tongue indented at anterior margin .... **Chaenogobius**
a2 Without Ist dorsal
 b1 Lower branchial aperture connected anteriorly; head not compressed bilatarally .... **Leucopsarion**
 b2 Lower branchial aperture not connected anteriorly; head compressed bilaterally .... **Luciogobius**

Genus Rhinogobius Gill, 1859.

Characters: Scales large, 22–38 in longitudinal series; usually not on lateral side of head and unfrequently on dorsal side of head from behind of eye and sometimes on belly. Glossopharyngeal simple.

Key to the Japanese species of Rhinogobius

a1 Scales about 30 in longitudinal series. Dark vermiform patterns on snout and lateral side of head. .... **Rh. giurinus**
a2 Scales 35 or more in lonigtudinal series. Without dark vermiform patterns. .... **Rh. similis**

110. Rhinogobius similis (Gill).

Read-fish, "Yoshinobori"

(PL. LVI, figs. 1–8)

Rhinogobius similis Gill, 1859, Proc. Ac. Nat. Sci., Phila.,p. 145. – Jordan, Tanaka et Snyder, 1913, Cat. Fish. Japa., p. 342 – Jordan et Hubbs, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 305, – Miyadi, 1935, Kyôto fuka Tansuigyo, pp. 43–44. – Miyadi. 1935, Shinsyû Gyorui, p. 230, fig. 134. – Niwa, 1954, Fish Valley, pp. 199–212, pl. 43.

Gobius similis JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., p. 372. – JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., xxiii, p. 759. – TOMIYAMA, 1936, Jap. Journ.. Zool., vol. 7, no. 1, pp. 68–70, figs. 22, A. & B. – OKADA et IKEDA 1938, Sci. Rep. Tôkyô Bun. Daigaku, Sect. B, no. 55, pp. 152–153. – OKADA et IKEDA, 1938, Saitô Ho-onkai Mus. Resear. Bull., no. 15, p. 116, pl. vii, fig. 3. – OKADA et IKEDA, 1938, Trans. Biog. Soc. Japan, vol. 3, no. 1, pp. 79–81, pl. iii, fig. 1. – AOYAGI, 1958, Gen. Notes Freshwater Fish. Jap. Arch., pp. 223–224, fig. 186.

Ctenogobius similis JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. xxiii, no. 1285, p. 759, pl. 35. – JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. xxiv, no. 1244, pp. 56–58. – TANAKA, 1908, Ann. Zool. Jap., vol. vii, pt. 1, p. 10. – TANAKA, 1909, Ann. Zool. Jap., vii, pt. 2, pp. 137–138.

Rhinogobius nagoyae JORDAN et SEALE, 1906, Proc. U. S. Nat. Mus., vol. xxx, p. 147, fig. 5.

Ctenogobius Kurodai TANAKA, 1908, Ann. Zool. Jap., vol. vii, p. 32. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, pp. 306–307.

Ctenogobius katonis TANAKA, 1908, Ann. Zool. Jap., vol. vii, p. 35.

Ctenogobius bedfordi, REGAN, 1908, Proc. Zool. Soc. Lond,,p. 62.

Ctenogobius candidius REGAN, 1908, Ann. Mag. Nat. Hist., (8), 1, p. 153.

Rhinogobius candidius OSHIMA, 1909, Ann. Carn. Mus., xii, p. 295.

Rhinogobius carpenteri SEALE, 1909, p. 593.

Rhinogobius sowerbyi GINSBERG, 1917, Proc. U. S. Nat. Mus., vol. 54, p. 100.

Rhinogobius taiwanus OSHIMA, 1919, Ann. Carn. Mus., p. 298, pl. LIII, fig. 1.

Rhinogobius formosanus OSHIMA, 1919, pl. 53, fig. 2.

Rhinogobius fluviatilus TANAKA, 1925, Fishes of Japan, vol. 34, p. 641, pl. 151, figs. 417, 418.

Tukugobius bucculentus HERRE, 1927, Gobbies Philip. & China Seas, p. 121.

Tukugobius philippinus HERRE, 1927, Gobbies Philip. & China Seas, p. 124.

Rhinogobius fukushimae, MORI, 1934, Rep. lst Scie. Exp. Manchukuo, p. 55, pl. 21, fig. 2.

Rhinogobius aestivarengia, MORI, 1934, Rep. lst. Sci. Exp. Manchûkuo, p. 56, pl. 21, fig. 3.

Description: Head 3 1/3 in length; depth 5; depth of caudal peduncle 2 1/3 in head; eye 5 1/2; snout 2 1/4; maxillary 2; D. VI–9 (10); A. 9 (10); P. 1, 19, 1; V. I, 5; C. 12, 14, 12; scales in longitudinal series 30, in transverse series 12.

Body elongate, cylindrical anteriorly, much compressed posteriorly. Head and body of nearly the same depth throughout, the caudal peduncle slightly constricted. Head very broad; its width contained 1 2/5 in its length; the muscles of the cheeks greatly developed, and bulged out far beyond the contour of the body. Eye small, directed obliquely upward, projecting above the dorsal outline of head, making the interorbital space slightly concave, slightly broader than diameter of eye. Snout long, with gently and evenly curved profile, rather blunt. Jaws about equal, the upper slightly projecting. Nostrils small, subequal, not very close to eye, anterior one tubular, the posterior with slightly elevated rim. Maxillary entirely concealed by the fleshy lip and overhanging preorbital, extending to a vertical passing between anterior edge of orbit and pupil. Teeth in narrow bands on both jaws; those in outer row of upper jaw considerably enlarged; the outer ones of lower jaw enlarged, though somewhat smaller than the corresponding ones above. The area bearing teeth extends farther back on the lower than on the upper jaw. Gill openings restricted to sides, running a little forward below; the width of the isthmus contained about 3 times in length of head; pseudobranchiae a little developed. Inner edge of shoulder girdle with a narrow ridge, but without papillae. Gill-rakers on first arch 2 + 9; short; pointed; far apart. Lower jaw without barbels.

Head naked: the skin loose and somewhat wrinkled, with a number of elevated mucous pores nearly as large as the nostrils; 1 on each side, above and before the eyes; 1 on the posterior part of interorbital space; 2 behind each eye, and a row of 4, the uppermost of which is largest, along the posterior edge of preopercle.

Scales large above, very small on belly; ctenoid growing smooth on anterior and on ventral parts. Nape with a naked space, the scales extending farther toward and bodering upper edge of opercle.

Dorsal fins separate, first dorsal inserted before middle of pectoral; second dorsal with subequal rays and gently curved margin. Spinous dorsal greatly elevated; the spines slender and filamentous at tips; the second largest, its height 3 1/2 in length; the third a little longer than the first, the last about a third as long as the second. Soft dorsal high, the posterior rays longert; when depressed, the tip of fin just reaches bases of first caudal rays. Anal inserted below third or fourth ray of second dorsal, not so high as dorsal; the fin; when depressed, falling far short of base of caudal. Caudal rounded posteriory. Pectorals without silky rays above, with broadly rounded posterior margin, almost reaching a vertical through vent. Ventrals short, joined to each other, the cup broader than long, not extending to halfway from its origin to vent, and extending slightly beyond origin of first dorsal; anal papilla distinct.

Table 116. Measurements of *Rhinogobius similis* GILL.*

	mm.									
Total length	75	73	63	70	69	66	60	60	54	60
Depth expressed in hundredths of length	18	17	21	20	19	20	20	18	18	19
Depth of Caudal peduncle	14	13	14	14	14	14	13	13	13	13
Length of Head	33	31	34	32	31	32	28	28	28	29
Length of Snout	15	13	16	14	13	14	12	10	11	11
Width of Interorbital space	2	2	2	2	2	2	2	2	2	2
Diameter of Orbit	5	6	6	5	6	6	7	6	6	6
Distance from Snout to spinous dorsal	42	41	44	43	43	42	40	39	40	42
Distance from Snout to soft dorsal	61	61	62	62	61	63	62	61	61	62
Height of longest dorsal Spines	23	29	27	30	24	28	15	14	16	18
Height of longest dorsal Rays	25	20	25	24	21	20	15	16	15	17
Distance from Snout to Anal fin	65	64	66	66	65	66	66	66	65	65
Height of longest Anal rays	17	15	16	17	15	15	15	16	14	15
Length of Caudal Peduncle	24	24	24	23	24	24	25	23	24	24
Length of Caudal fin	26	26	26	25	26	26	24	25	24	26
Length of Pectoral fin	25	23	24	24	23	23	26	25	24	26
Length of Ventral fin	12	11	13	13	12	12	12	12	12	12
Number of Dorsal spines	6	6	6	6	6	6	6	6	6	6
Number of Dorsal rays	9	10	9	9	9	9	9	9	9	9
Number of Anal rays	9	10	9	9	9	9	9	9	9	9
Number of Pectoral rays	19	19	19	19	19	19	20	19	19	20
Number of Scales in lateral series	31	31	30	31	29	29	28	32	31	33
Number of Scales in transverse series	11	11	11	11	10	11	10	11	10	10

*These measuements were made by JORDAN et SNYDER for the specimens collected at Ishikawa and Nagasaki Prefectures.

Color in alcohol, light brown, the tint not being uniform, but darker near the center of each scale; sides with four or five very indistinct large dark blotches. Fins a little darker than body, upper anterior edge of soft dorsal white; soft dorsal, anal and caudal

Table 117. a. Measurements of *Rhinogobius similis* GILL.

Sp. No*.	Standard length	Head in length	Depth body in length	Eye in head	Snout in head	Interorbital space	Depth of caudal peduncle in head	Dorsal fin	Anal fin	Scales in longitudinal series
222a	60. 3mm.	3. 0	4. 6	5. 0	2. 6	8. 4mm.	2. 5	VI, I, 8+1	I, 8+1	35
222b	56. 3	3. 1	4. 4	4. 1	2. 7	10. 0	2. 7	VI, I, 8+1	I, 8+1	35
222c	48. 9	3. 0	5. 1	4. 6	2. 7	9. 1	2. 6	VI, I, 8+1	I, 8+1	31
222d	48. 5	3. 1	5. 6	4. 4	2. 5	7. 8	2. 5	VI, I, 8+1	I, 8+1	34
222e	37. 9	3. 3	5. 1	3. 8	3. 4	9. 6	2. 8	VI, I, 8	I, 8	35
223a	54. 0	2. 9	5. 9	4. 7	2. 6	12. 5	2. 7	VI, I, 8+1	I, 8+1	36
223b	49. 5	3. 0	5. 8	4. 8	2. 7	11. 8	2. 6	VI, I, 8+1	I, 7+1	40
223c	48. 8	2. 9	5. 9	4. 2	2. 7	11. 9	2. 6	VI, I, 9+1	I, 8+1	37
223d	43. 7	3. 1	5. 3	4. 2	2. 9	12. 7	2. 5	VI, I, 8	I, 7+1	36
223e	39. 9	2. 9	5. 9	4. 3	2. 8	10. 5	2. 7	VI, I, 8+1	I, 8	34
223f	37. 8	3. 1	5. 5	3. 7	3. 2	11. 2	2. 7	VI, I, 8+1	I, 8	33
223g	37. 4	3. 1	5. 6	4. 1	2. 9	12. 0	2. 4	VI, I, 8+1	I, 8+1	37
223h	36. 3	3. 3	5. 2	4. 1	2. 8	13. 8	2. 4	VI, I, 8+1	I, 7+1	34
223i	32. 0	3. 0	5. 6	3. 6	2. 9	15. 3	2. 7	VI, I, 8+1	I, 8+1	33
225a	54. 6	3. 1	5. 3	4. 4	2. 6	7. 1	2. 6	VI, I, 8+1	I, 8+1	33
225b	49. 9	3. 3	4. 9	3. 9	3. 0	7. 9	2. 7	VI, I, 8+1	I, 8+1	36
230	46. 3	3. 3	5. 0	4. 2	2. 8	7. 0	2. 4	VI, I, 8+1	I, 8+1	?
244a	32. 0	3. 0	5. 0	3. 9	2. 7	7. 1	3. 0	VI, I, 9	I, 8	29
244b	25. 5	3. 1	4. 6	4. 2	3. 0	10. 1	2. 9	VI, I, 7+1	I, 9	28
335a	46. 8	3. 7	4. 8	3. 7	2. 8	6. 4	2. 1	VI, I, 8+1	I, 9	34
335b	46. 4	3. 5	4. 1	3. 2	3. 1	7. 0	2. 1	VI, ?	I, 9	35
335c	42. 5	3. 5	4. 1	4. 3	3. 0	10. 0	2. 2	VI, I, 8+1	I, 8+1	35
425a	38. 1	2. 7	4. 8	4. 4	2. 8	7. 0	3. 0	VI, I, 8+1	I, 7	26
425b	33. 2	3. 0	5. 4	4. 3	3. 3	8. 4	2. 7	VI, I, 8+1	I, 6+1	29
425c	31. 2	2. 9	4. 6	4. 2	3. 1	8. 2	2. 9	VI, I, 8+1	I, 8	29
624a	34. 0	2. 6	5. 2	3. 6	2. 9	10. 3	3. 2	VI, I, 8+1	I, 8	30
324b	29. 1	2. 7	5. 2	3. 5	2. 8	7. 7	3. 3	VI, I, 8+1	I, 8	31
566a	44. 7	2. 3	5. 4	4. 0	3. 1	8. 4	2. 5	VI, I, 8+1	I, 8+1	33
566b	35. 0	3. 4	4. 6	4. 2	3. 5	7. 8	2. 6	VI, I, 8+1	I, 8	

*These measurements were made by OKADA and IKEDA for the specimens from Okinawa in 1937.

bordered with white, especially in the adult.

Type locality: near Shimoda.

Distribution: Ishikawa Prefecture (JORDAN & SNYDER); Tsushima (JORDAN & SNYDER); Nagoya (JORDAN & SEALE); Tôkyô (TANAKA); Ishikawa Prefecture (TANAKA); Himeji, Hyôgo Prefecture (TANAKA); Tôkyô; Nagasaki; Lake Biwa, Tsushima; Aomori; Iyo, Shikoku; Kurume; Kawatana; Nagasaki, Kyûshû (JORDAN & SNYDER); Shimoda (GILL); Ishikawa Province (JORDAN & SNYDER); Yokohama; Tsushima (JORDAN & SNYDER); Yokohama; Inland sea of Japan (GUNTHER); Tôkyô; Lake Biwa; Ishikawa Prefecture; Lake Biwa; Tsushima; Nagasaki; Kurume; Kaga; Kana R., Kawatana; Iyo (JORDAN & SNYDER); Shimoda, Shizuoka Prefecture (GILL); Lake Toya; Kake Abashiri, Hokkaidô (OKADA & IKEDA); Kaga; Tôkyô (TANAKA); Okinawa (OKADA & IKEDA); River Iwaki, Hirosaki, Aomori Prefecture; Taya, Higashitori-mura, Shimotaka-gun, Aomori Prefecture; Ueta, Morioka, Iwate Prefecture; River Sarugaishi, Hareyama, Waga-gun, Iwate Prefecture; Wakayanagi, Kurihama-gun, Miyagi Prefecture; River Uchi, Tsuruoka, Yamagata Prefecture (OKADA & IKEDA); Lake Biwa; Kyôtofu (MIYADI); Shinshû, Nagano Prefecture (MIYADI); Shinano; Yokohama; Shimoda; Idzu; Kake Biwa; Nagasaki (JORDAN, TANAKA, SNYDER); Kumamoto; Ôzu, Shiga Prefecture (WAKIYA); River Hiki, Shirahama, Wakayama Prefecture (JORDAN); Lake Biwa, Ôtsu (JORDAN & KAWAMURA); Lake Hakone; Lake Suwa (JORDAN); Yamaguchi; Fukui (JORDAN & HUBBS); Momose, Tokiwa, Kihama, Matsubara, Lake Biwa, Shiga Prefecture (TANAKA); Pond of Kuroda, Tôkyô (TANAKA); Kanazawa, Ishikawa Prefecture (TANAKA); Kiso Valley; Kiso Fukushima, Nagano Prefecture; River Hida; River Nagara, Gifu Prefecture; River Nakatsu, Aichi Prefecture; Inuyama, Aichi Prefecture; (NIWA); Lake Suwa, Nagano Prefecture (UCHIYAMA); Lake Abashiri, Lake Dôya Hokkaidô (OKADA & AOYAGI); River Atsuta; Hokkaidô (SH. OKADA); Lake Towada (HIKITA); Okayama Prefecture (OSHIMA); River Masuda, Gifu Prefecture (OSUMOTO), River Kumozu, Tsu City, Mie Prefecture (OKADA & KUBOTA); River Yahagi, Aichi Prefecture (UMEMURA); Kawarada, Sado (OSHIMA); River Midori, Kumamoto Prefecture (KOBA).

Remarks: TOMIYAMA I.[1)] noted that his specimens not so well agree with the description of *Rhinogobius similis* GILL which somewhat suggests *Gobius giurinus* RUTTER. He has figured two types of the pattern; one has a grayish median longitudinal streak along the side of body and 4 irregular dotted blotches on the back of body and the other has irregular grayish bars on the side of body and a blackish spot at the base of pectoral. The specimens from Okinawa show the various types of patterns, including the above two types.

JORDAN et SNYDER, 1901, pointed out the sexual difference of the present species. The females have a shorter snout and smaller mouth; much lower and shorter fins, with the white borders narrow and indistinct. The females have 2 or 3 rows of small

1). TOMIYAMA, I. 1936. Jap. Journ. Zool., vol. 7, no. 1, pp. 69–70.

dark brown spots, 1 spot on each scale of upper part of body, and a very narrow lateral band of the same color, more distinct posteriorly, extending along the sides.

TANAKA[1] mentioned *Rhinogobius similis* GILL seems to be marine in habit, may be synonymous with *Gobius gymnauchen* BLEEKER and pure freshwater one was identified with *Rhinogobius fluviatilis* as a new species.

JORDAN and HUBBS[2] noted the variations of the present species. They have found the individual variations, differing with age, sex, locality and individuals. "The individual variations chiefly involve the squamation: the relatively large scales of the body may impinge directly on the entirely naked nape, or these scales may gradually become reduced in size anteriorly, and extend well toward, in rare cases almost to, the occiput; in correlation with this variation in size, the scales vary in number from about 30 to about 40 between the gill-slit and the caudal base. These variations in squamation cover the characters of several normal species, *Rh. nagoyae* of Japan, *Rh. bedfordi* of Korea, and *Rh. candidius* and *Rh. taiwanus* of Formosa. We have examined large series from Formosa, as well as from Japan, and have examined the type of *Rhinogobius nagoyae*, which in every way is typical of *Rh. similis*.

TANAKA[3] established a new species *Ctenogobius kurodai* from the specimens of a freshwater ponds in the garden of Dr. KURODA in Tôkyô. He has distinguished the present new species by the chief different characters from any species of Japan as follows.

"The head broader than high; snout short; ventral small, not reaching to the perpendicular passing through tip of pectoral; vertical fins all with a somewhat small number of rays, nape closely scaled."

He has also described a new species *Ctenogobius katonis* from the specimens collected at Kanazawa, Ishikawa Prefecture. He noted that the present new species is very closely allied to *Rhinogobius nagoyae* JORDAN et SEALE but differs from this in having scaly nape and in the shorter maxillary which does not extend to the anterior rim of orbit.

NIWA described the habits of the present species in his book titled "on Fishes of Kiso Valley" in 1954. *Gobius similis* (*Rhinogobius similis*) deposited eggs under the stones on the sandy bottom of rivers during June and July. The male always guarded eggs after the female deposited. Most of the female are going to die after the spawning by destroying her body. The egg is elliptical with transparent and stiff egg membrane. Many sticky attaching filaments are located at the base of eggs by which the eggs firmly attached to a surface of stone. It measures 6.0mm. × 2.5mm. in size and the filaments are lengthened 3.0 mm. He supposed the very interesting movements of eye of embryo just before hatching out may induce the hatching fermental gland developed around eye as in that of *Gnathopogon elongatus* observed by ISHIDA, J. in 1948. By the contraction of ocular muscle caused the shrink of the epithelium around eye and the destroy of fermental gland mechanically, and secrets a hatching ferment for hatching out. NIWA also pointed out the interesting fact for formation of ventral sucker by confusion of two ventral fins.

1). TANAKA, 1925, Fish. Japan, p. 644.
2). JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 305.
3). TANAKA, 1908, Ann. Zool. Jap., vol. vii, pt, b, pp. 32-35, pp. 35-38.

Concerned with the development of ventral sucker, the present author[1] observed the development of *Gobius similis* and noted as follows. In the young measured 12.5 mm. in total length, ventrals are not yet as well formed as the sucker. In the young measured 18.0 mm., all of the fins well formed, especially the ventrals, which formed into a sucker.

Development: Egg (pl. LVI, fig. 4) transparent, small, spindle shaped, 2.0 mm. in long axis, pedunculated at the end, with a very granular yellow yolk and few oil globules. It is attached under a flat surface of stone by the end of a short peduncle. Incubation period takes about 4 days at 24°C water temperature.

Embryo: Newly hatched larva (pl. LVI, fig. 5), total length about 3.0 mm. body length, from snout to vent, 1.28 mm.; diameter of eye, 0.23 mm.; myomeres 9 to vent plus 22 (incomplete) behind. Body elongate, transparent with a large yellow oil globule lying at ventral margin of yolk sac; eye is very large; maxilla movable. Air-bladder small; pectoral developed. Pigmentation; the eye is coloured a metallic blue, and the air-bladder a golden brown. Faint black pigment arises at the ventral ridge of intestine and also ventral margin of myomeres from vent backward to caudal.

Young with 12.5 mm. body length (pl. LVI, fig. 6): Dorsal VI, 9; anal 9; Total length 12.5 mm. Head length, 2.96 mm.; diameter of eye, 2.81 mm.; snout length, 0.63 mm., vertebrae 26 in number. Body almost transparent, and all of the fins well rayed; head pointed at end; mouth oblique, lower jaw is slightly projecting than upper jaw. Ventrals are not performed as a sucker. Pigmentation. About elven large black spots occur on the ventral ridge extending from vent to caudal and on the basal region of opercles and caudal fins.

Young with 18.0 mm. body length (pl. LVI, fig. 7); Total length, 18.0 mm., body length 15.0 mm,; diameter of eye 1.10 mm.; snout length 0.88 mm. Body wholly scaled, and all of the fins well formed. Especially ventrals, which are formed into a sucker are performed. The mouth is large, extending from maxillary to pupil. Branched rays develop in the truncated caudal fins. The young of this stage changes from a pelagic to a bottom life. Pigmentation: On the side of body there are about six black patterns. There are many pigmented areas on both jaws, cheeks, opercular region and dorsal margin from head backward to caudal fins.

Young with a 20.0 mm. body length (pl. LVI, fig. 8): Total length, 20.0 mm., body length 16.6 mm.; body height 3.07 mm.; head length 4.85 mm.; diameter of eye 1.21 mm.; snout length 1.13 mm.. Color patterns nearly completed. The youngs are bottom dwellers.

Habits: The present species is a summer spawner. After a few females deposit many eggs (500–7000 in number) on the under surface of a rather large flat stone, a male with a nuptial coloration guards the eggs under it, until the larvae hatch out. Most of the food is composed of Crustaceans, chiefly Cyclops.

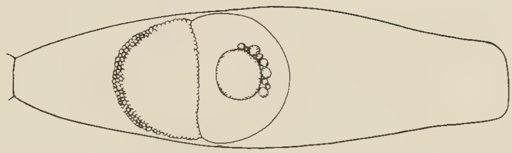
1). Okada et Seishi, 1938, Bull. Biog. Soc. Japan, 8(15), pp. 223–253.

PLATE LVI

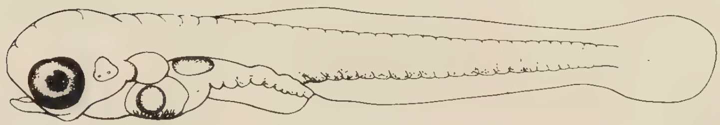
Development and adults of ***Rhinogobius simitis*** GILL.

1. Egg.
2. Newly hatched larva, 3 mm. in body length.
3. Juvenile, 12.5 mm. in body length.
4. Juvenile, 18 mm. in body length.
5. Juvenile, 20 mm. in body length.
6. Adult of *Rhinogobius similis* GILL. ♂ × 1
7. Adult of *Rhinogobius similis* GILL. ♀ × 1
8. Adult of *Rhinogobius similis* GILL.

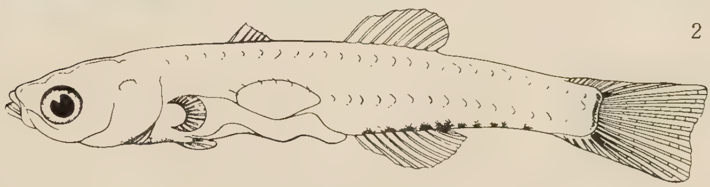
PLATE LVI



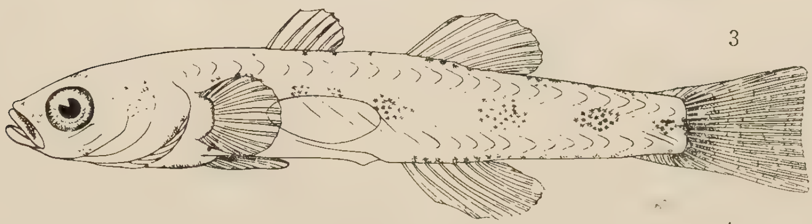
1



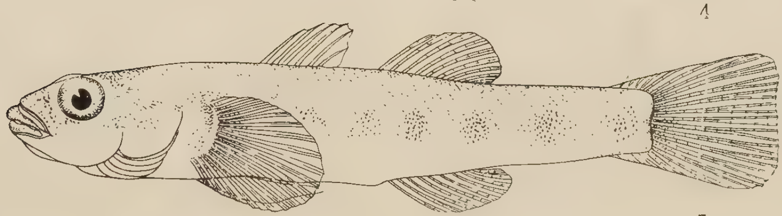
2



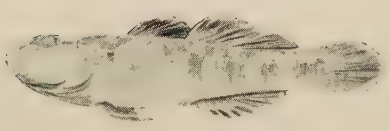
3



4



5



6



7



8

111. Rhinogobius giurinus (RUTTER).
"Gokurakuhaze"

Gobius giurinus RUTTER, 1897, Proc. Acad. Nat. Sci. Phila., vol. XLIX, p. 86. - AOYAGI, 1958, Gen. Notes Freshwater Fish. Gap. Arch., pp. 222-223, fig. 185.
Ctenogobius handropterus JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., xxiv, p. 60, fig. 7.
Ctenogobius platycephalus JORDAN et EVERMAN, 1903, Proc. U.S. Nat. Mus., xxv, no. 1289, p. 362.
Rhinogobius giurinus JORDAN et RICHARDSON, 1909, Mem. Carn. Mus., iv, p. 200. - OSHIMA, 1919, Ann. Car. Mus., xii, p. 297. - JORDAN et HUBBS, 1925, Mem. Carn. Mus., x, no. 2, p. 305. - TANAKA, 1925, Fish. Japan, pp. 650-654, pl. clii, figs. 421-422. - UI, 1932, Kisyugyofu, p. 245. - MIYADI, 1935, Kyotofu Tansuigyo, p. 44 - OKADA et IKEDA, 1938, Trans. Biog. Soc. Japan, vol. 3, no. 1, pp. 81-42, pl. iii, fig. 2. - NICHOLS, 1943, Freshwater Fish China, p. 264.

The original description* is as follows.

Gobius giurinus RUTTER New species

A single specimen, 3 in. long, No. 4,990, Leland Stanford, Jr. University Museum, differs from *Gobius giurus* in the longer and more depressed snout, horizontal mouth with ower jaw not prominent and larger scales in front of dorsal.

Head 3 ½, de pth 6, eye 4; D. VI-9; A. 9; scales 28-9.

Body long, compressed posteriorly; head depressed, somewhat wider than high; profile evenly curved; eye very close together, the interorbital not so wide as pupil; snout a little over ⅓ of head; jaws even, the premaxillary very broad on top of snout, its width half length of eye; mouth nearly horizontal, teeth all small, two rows in sides of upper jaw, one row in side of lower jaw, in a band in front of each, broader in lower, no canines; maxillary to below anterior margin of eye; head scaleless, but few scales on breast, 10 scales in front of dorsal; spinous dorsal as high as body, soft dorsal of same height, distance of last dorsal from caudal equal that of first dorsal from middle of eye; pectorals reach past ventrals, 1 ⅓ in head; ventrals 1 ½ in head; anal not so high as soft dorsal. Color, in alcohol, pale white five indistinct brown cross bars, a brown blotch at upper base of pectoral, a faint one at base of caudal, soft dorsal with numerous round dusky spots, caudal and anal minutely dusted with black, pectorals and ventrals colorless.

Description: Depth in length to base of caudal, 5; head, 3.3; eye in head, 4.5. Dorsal rays, VI-10; anal, 8; scales, 32.

Body elongate, slightly compressed; posteriorly back gently and evenly curved, profile; eye small, upwardly oblique, much nearer tip of snout than that of opercular flap, impinging upon profile; interocular concave, narrow, one-half eye-diameter; snout moderately long, 1.8 times eye-diameter, rather pointed, with gently curved profile; nostrils two separate, anterior one with a short tube, posterior larger, slit-like, midway between anterior rim of eye and anterior nostril; maxillary entirely concealed below preorbital, extending to below anterior rim of eye; cheeks rather teemed. Mouth moderate, slightly oblique, with lateral cleft; lower jaw slightly the shorter; upper lip thick; dentition in both jaws subsimilar, acute teeth near tip, with a wide patch of

*RUTTER, 1897. Proceedings of the Academy of Natural Sciences of Philadelphia. p. 86.

smaller teeth inwardly, followed by a row of similar teeth laterally; no teeth on vomer nor palatines; tongue broad and truncate at tip. Gill-opening lateral, oblique, extending from upper edge of base of pectoral to a little beyond its lower edge; joined to the broad isthmus, width of which is 1.2 times eye-diameter; gills 4; gill-rakers on first gill-arch short, pointed, much shorter than eye-diameter, 2+9 in number. Two dorsals well separated: first dorsal inserted behind base of pectoral, the spines increasing in length to the fourth which is longest; second dorsal with broadly rounded margin, longest rays a shorter than the longest spine of the first dorsal; anal inserted below second ray of second dorsal, its form similar to second dorsal, both falling to same vertical and far short of base of caudal, pectoral subsymmetrical, rather acutely pointed, exntending to vertical to vent; ventral inserted below base of pectoral, not extending to vent: vent midway between tip of ventral and insertion of anal, and a little nearer preopercle edge than base of caudal; anal papilla prominent; caudal slightly rounded, caudal peduncle much compressed, its length from last ray of second dorsal two times its depth. Scales large, nape and occiput covered closely with smaller cycloid scales; head otherwise naked; no lateral line.

Table 118. Measurements of *Rhinogobius giurinus* (RUTTR).

Collection	O. H. B. S.*		
Total length	48. 0mm.	62. mm.	56. 0mm.
Body length	38. 0	51. 00	45. 5
Body lengtt/Head	3. 09	3. 00	3. 00
Body length/Depth	4. 87	4. 77	4. 55
Body length/Predorsal length	2. 41	2. 42	2. 39
Body length/Prepectoral length	3. 04	2. 95	2. 85
Body length/Preventral length	2. 92	2. 90	2. 97
Body length/Preanal length	1. 62	1. 59	1. 57
Head/Snout	2. 74	2. 74	2. 62
Head/Upper jaw	2. 36	2. 50	2. 34
Head/Interorbital width	6. 85	8. 50	8. 45
Head/Diameter of Eye	4. 10	3. 95	3. 80
Head/Length of Caudal peduncle	1. 34	1. 42	1. 35
Head/Depth of Caudal peduncle	2. 74	3. 22	2. 92
Head/Length of Dorsal fin I	2. 93	2. 62	3. 16
Head/Length of Dorsal fin II	2. 46	2. 18	2. 25
Head/Length of Anal fin	2. 12	2. 54	2. 34
Head/Height of Dorsal fin I	1. 81	1. 83	1. 97
Head/Height of Dorsal fin II	1. 71	1. 93	1. 77
Head/Height of Anal fin	1. 84	2. 18	2. 05
Head/Pectoral length	1. 16	1. 31	1. 32
Head/Ventral length	1. 36	1. 74	1. 52
Date	I, 1923		
Locality	Lake Ikeda, Kagoshima Prefecture		

*Otsu Hydrobiological Station attached to Kyôto University.

Color in formalin, above brownish, below lighter, six dark large spots along median line of body more or less connected with one another by much smaller and fainter spot, faint broad patches on back, alternating with the distinct lateral spots, with which

they more or less unite and also with the smaller faint spots on the median; head profusely marked by many wavy narrow lines, which are much narrower than interspaces, fusing together in places; two dorsals and caudal with many rows of brown spots; second dorsal and caudal with very narrow whitish margin; anal and pectoral whitish, the latter fin with a dusky, curved band near base, which band is continuous with a dark patch on upper end of the base of fin, the base itself largely white; ventral dusky, its posterior margin very narrowly white.

Type locality: Swatow, China.

Distribution: Nagasaki; Kurume; Tsuruga; Kawatana, Kumamoto Prefecture (JORDAN & SNYDER); Chiba Prefecture (TOMIYAMA); River Kachi, Nagoya; Lake Togo Inabe (JORDAN & HUBBS); Himeji, Hyôgo Prefecture (TANAKA); River Kachi, (JORDAN & HUBBS); Kyôtofu (MIYADI); Kôtôshô; Taihoku, Formosa (JORDAN & RICHARDSON); Tone River, Ibaraki Prefecture (TAKATSUKA); Hachirôgata, Akita Rrefecture (AOYAGI & IDE).

Genus **Acanthogobius** GILL, 1859.

Acanthogobius GILL, 1859, Proc. Ac. Nat. Sci. Phil., p. 145.

Type·········**Gobius flavimanus** T. et SCH.

Characters: Body oblong, little compressed, covered with medium sized rough scales; cheeks with small scales; snout rather long, the head rounded in profile; mouth moderate, oblique, the jaws about equal, the teeth moderate; tongue truncate or very slightly notched, isthmus rather broad, the gill openings slightly continued forward below; no flaps on shoulder girdle. Dorsal fins rather long, the first of 7 to 9 slender spines, the second of 14 or 15 soft rays; anal of 12 to 13.

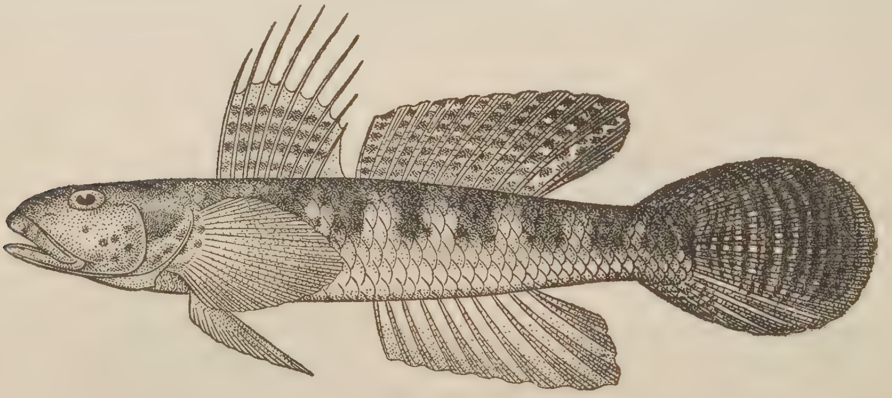
Key to Japanese species of Acanthogbius

a¹ Dorsal spines 7 to 12 (usually 8 or 9); anterior fraenum of ventral sucker with fringed margin.
  b¹ Scales 35 to 40; head naked ·········· **A. lactipes**
  b² Scales 55 to 75; top and sides of head scaly.
    c¹ Soft dorsal rays 1–12 to 14; caudal peduncle slightly shorter than soft dorsal base ·········· **A. flavimanus**
    c₂ Soft dorsal rays 1–18 to 20; caudal peduncle shorter than half length of soft dorsal base ·········· **A. hasta**

112. **Acanthogobius lactipes** (HILGENDORF).

Rush white Goby, "Ashishiro haze"
(Text-fig. 113)

Gobius lactipes HILGENDORF, 1878, Sitzber. Naturf. Freunde, p. 109.
Aboma lactipes JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., p. 109; JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. xxiv, no. 1244, p. 67, fig. 10. – JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Jap., p. 347, fig. 298. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 307.
Aboma tsushimae JORDAN et SNYDER, 1901, p. 759. – JORDAN et SNYDER, 1901, p. 69, fig. 11. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 307.
Acanthogobius lactipes TOMIYAMA, 1936, Japa. Journ. Zool., vol. vii, no. 1, pp. 84–85. – OKADA et IKEDA, 1933, Sci. Rep. Tôkyô Bun. Daig., Sect. B, no. 28, p. 153. – OKADA et IKEDA, 1938, Saito Ho-onkai Mus., Resear. Bull., no. 15, p. 116. – OKADA et NAKAMURA, 1648, Freshwater Fish. Gap. Arch., p. 234, fig. 192.



Text-fig. 113. ***Acanthogobius lactipes*** (HILGENDORF).

The original description* is as follows:

Gobius lactipes (1897) HILGENDORF

D. 8/12, A 11, L. 1, ca. 40, L tr. (D. II/A) 9.

Körperhöhe in Länge 7½ mal; Kopfl. in Körperl. 4½; Kopfhöhe in Kopfbr. 1¼; Augendurchm. in Kopf. 3¾, in Schnauzen. 1⅛; Interorbital breite im vertikalen Augendurchm. 2. Die Maxille erstrecktt sich bis unter das erste Viertel des Auges; die Oberkinnlade tritt vor; Schnauzenprofil ziemlich starkconvex. Die Höhe der beiden Rückenflossen übertrifft die Körperh. nicht; sie stehen Ziemlich entfernt von einander; die C bleibt hinter dem Kopf an Länge zurück (5/6). Die Zähne stehen oben und inten mehrreihig; die äusseren sind grösser, keine Caninen. Die Schuppen beginnen vereinzelt erst ein gut stück hinter den Augen; die Wangen, die Pektoral basis, der Gange Bauch vorder V und ein Streifen hinter derselben nackt. Schuppen mit etwa 25 Zähnchen am Saum.

Bezüglich der Färbung fällt vor Allem ein breiten milchweisser Streif in der Mitte der vereinigten Ventralen auf dem letzten Strahl jeder Flosse einnehmend, während die seiten, theile schwärzlich sind. Körper braun mit unregelmässigen Kleineren und grösseren dunklen Flecken; vom Auge gehenme-

*HILGENDORF, 1878. Sitzber. Naturf. Freunde, pp. 109–110.

hrere dunkle Streifen abwärts; die P. ist nur auf der Basis gefleckt; die D. I. II und die oberen zwei Drittel der C. mit dunklen Binden, die A. mit einem schwärzlichen Ton; Unterkopf fein punktirt die Bauchseite hell graubraun, unter V. weisslich. Mus., Ber., no. 10650.

Ann. Lyc. Nat. Hist. New York, VII, p.13-14.

Description: Head $3^3/_4$ in length; depth $4^2/_3$; depth of caudal peduncle 10; eye $5^1/_2$ in head; snout $2^3/_4$; D. VIII–11; A. 11; P. 18; scales in lateral series 36, in transversr series 10.

Body cylindrical anteriorly, sloping gradually to the rather deep caudal peduncle. Head large; snout long; blunt. Eyes small; situated high up; nearer to tip of snout than to posterior edge of opercle a distance equal to one-half the diameter; directed almost laterally. Mouth almost horizontal; jaws equal; upper lip wide; maxillary concealed except at distal end; reaching a vertical passing midway between anterior edge of orbit and pupil. Teeth simple; in a narrow band on each jaw; outer ones but little enlarged. Tongue rather broad; its anterior edge truncate or slightly rounded. Gill opening restricted to the sides; width of isthmus a little less than length of snout. Inner edge of shoulder girdle with a low, narrow, sharp ridge, but no papillae. Gill-rakers 1+7; short; flat. Anterior nostrils with low tubes. No barbel on lower jaw. Head naked. Body with large, finely ctenoid scales; those on sides of nape, breast anterior to ventrals and region before pectorals naked.

Dorsal separate; spines and rays of about equal height; the spinous dorsal when depressed reaching insertion of soft dorsal. Anal inserted below base of second dorsal ray; the rays a little shorter than those below base of second dorsal ray; the rays a little shorter than those of dorsal; neither reaching bases of caudal rays. Caudal rounded. Pectorals rather pointed; the upper border without free filaments. Ventrals very large, extending to anal opening, free posteriorly.

In alcohol the upper part of the body suffused with dusky; sides with 9 rather definite, dark vertical bands, extending from a little below the middle of body upward; darker near their lower edges. Head dark; a narrow blackish line running from eye to tip of maxillary; under parts without dusky, except on throat and chin. Spinous dorsal edged with white; interradial membranes dusky; jet black on upper posterior part of fin; soft dorsal with small, oblong, dark spots arranged in rows. Upper two-thirds of caudal with vertical, zigzag bands; the lower third dusky; without bands. Anal dark; narrowly bordered with white; pectoral dusky. Ventral with a white, median area broadly bordered with black.

Color in life, lemon yellow; middle area of ventrals bright yellow, slightly tinged with orange; spinous dorsal edged with orange; anal with a narrow marginal band of dead white.

Type locality: Tôkyô.

Habits: The present species likes to live on sandy mud bottom and feeds on small animals. It lives in lower streams or lakes and swamps along the sea coast, making groups.

Distribution: Usu, Hokkaidô; Lake Hachiro-gata; Akita; Namerikawa, Toyama Prefecture; Kesen, Iwate Prefecture; Arahama, Miyagi Prefecture; Lake Kasumigaura; Ariake sand, (TOMIYAMA); Tsuruga, Fukui Prefecture; Bay of Hondô; Matsushima, Miyagi Prefecture; Tôkyô; Enoshima, Kanagawa Prefecture; River Tone, near Tôkyô (JORDAN & SNYDER); Lake Abashiri (OKADA & IKEDA); Hachirôgata, Minami-Akita-gun, Akita Prefecture (OKADA & IKEDA); Lake Kitagata, Fukui Prefecture; Noo, Niigata Prefecture (JORDAN & HUBBS); Tsushima (JORDAN & SNYDER); River Ishikari, Dôya Lake, Lake Nôtori, Lake Abashiri (AOYAGI); Morioka, Iwate Prefecture (KOYAMA).

Remarks: JORDAN et SNYDER* noted some variations of color and patterns. The some specimens collected from the bay at Tsuruga, Fukui Prefecture have the very indistinct lateral bands, the sides being covered with small dusky spots. The other specimens from the same locality have the lighter color pattern. A large male specimen has a series of narrow, bright, transverse lateral bands on the sides. The soft dorsal is distinctly edged with white. Occasionaly in males the anterior spines of the first dorsal have very long filaments exending above the margin of the fin.

Table 119. Measurements of *Acanthogobius lactipes** (HILGENDORF).

Length of body	72mm.	72mm.	66mm.	56mm.	48mm.
Depth expressed in hundredths of length	22	22	22.5	21	21
Depth of caudal peduncle	10.5	10	9.5	10	10
Length of head	27	27	26	27.5	28
Length of snout	10	10	10	11	11
Width of interorbital space	2	2.5	2	2	2
Diameter of orbit	5.5	5.5	5	6	6
Distance from snout to spinous dorsal	34	34	34	35	36
Distance from snout to soft dorsal	56	55	55	55	57
Height of longest dorsal spine	16	15	15	15	15
Height of longest dorsal ray	17	15.5	16	15.5	16
Distance from snout to anal fin	56	57	60	58	59
Height of longest anal rays	15	14	13	14	16
Length of caudal peduncle	22	23	22	22	23
Length of caudal fin	24	24	25	26	25
Length of pectoral fin	22	23	23	24	25
Length of ventral fin	24	25	22	27	25
Number of dorsal spines	8	8	8	8	8
Number of dorsal rays	11	12	11	12	11
Number of anal rays	11	11	10	11	11
Number of pectoral rays	18	18	18	18	18
Number of scales in lateral series	36	37	35	35	35
Number of scales in transverse series	10	10	9	9	9

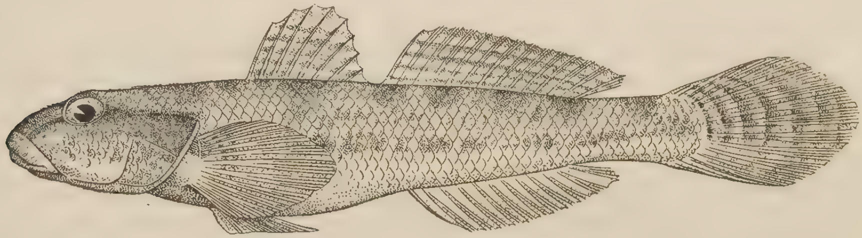
* This measurement was made by JORDAN and SNYDER for the specimens collected at Tsuruga, Fukui Prefecture in 1901.

113. **Acanthogobius flavimanus** (TEMMINCK et SCHLEGEL).
True Goby, "Mahaze"
(PL. LVII, figs. 1–21; Text-fig. 114)

Gobius flavimanus TEMMINCK et SCHLEGEL, 1845, Faun. Jap., Poiss., p. 141, pl. 74, fig. 1. – BLEEKER, Ver. Bat. Genootsch., Japan, p. 42. – GÜNTHER, 1861, Cat. Fish., iii, p. 77. – ISHIKAWA, 1898, Cat. Fish., p. 38.

Acanthogobius flavimanus GILL, 1859, Proc. Ac. Nat. Sci. Phila., p. 145. -JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. xxiv, no. 1244, pp. 98–99. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, no. 4, p. 289. – JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Jap., p. 356. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 308. – UI, 1932, Kishu Gyofu, p. 242. – TOMIYAMA, 1936, Jap. Journ. Zool., vol. vii, no. 1, p. 85. – OKADA et IKEDA, 1938, Sci. Rep. Tokyô Bun. Daig., sect. B, no. 55, p. 153. – OKADA et IKEDA, 1938, Saito Ho-onkai Mus., Resear. Bull., no. 15, pp. 116–117, figs. 14. – AOYAGI, 1958, Gen. Notes Freshwater Fish. Jap. Arch., pp. 235–236, fig. 193.

Aboma snyderi JORDAN et FOWLER, 1902, Proc. Unit. Stat. Mus., vol. xxv, no. 1298, pp. 575–576.



Text-fig. 114. ***Acanthogobius flavimanus*** (TEMMINCK et SCHLEGEL).

The original description* is as follows:

Gobius flavimanus Pl. LXXIV, fig. 1.

Un museau passablement allongé, et le nombre des dorsale et de l'anale forment les traits caractéristiques de cette espèce inédite. Elle offre, quant à son aspect général et à la disposition de ses teintes, une certaine analogie avec le *Gobius baliurus*; mais cette espèce s'en distingue facilement par ses dorsales et son anale composées de rayons moins nombreux.

La hauteur du corps entre six fois et demie dans la longueur totale du poisson; la longueur de la tête y est un peu plus de quatre fois, et le museau est deux fois et deux tiers dans la tête. La ligne du museau est très-peu courbée. Les yeux sont de grandeur moyenne et tellement rapprochés du sommet de la tête, que l'entre-deux des yeux fiat un peu moins que le diamètre de ces organes. Je ne remarque, de chaque côté, qu'un seul orifice de la narine, placé qu milieu de l'espace compris entre l'aeil et l'extremité du museau. L'angle de la bouche se trouve sous l'aplomb de la fin du deuxieme tiers de la longueur du museau. Les mâchoires sont armées chacune de plusieurs rangées de petites dents, dont les antérieures sont un peu plus grandes que les autres. L'opercule est alongé et s'étend avec sa pointe jusque vers la base du rayon supérieur des pectorales. Les écailles sont peu grandes. La ventrale n'est pas très-développée; il en est de même des pectorales, qui offrent la forme d'une feuille simple, à pointe conique. La première dorsale nait au dessus de l'aiselle des pectorales; son premier rayon est un peu plus court que le deuxiéme, les autres diminuent successivement et reguliè-

*TEMMINCK & SCHLEGEL, 1845, Fauna Japonica Poisson, p. 141, pl. LXXIV, fig. 1.

rement en longueur. La seconde dorsale nait immédiatement derrière la première; elle est par devant un peu plus haute que par derrière. L'anale répond par sa forme à la deuxiéme dorsale; mais elle est plus courte que cette nageoire. La caudale est assez large et arrondie. D. 8 et 15; A. 12; V. 10; P. 16; C. 18, à l'exception des petits rayons supérieurs et inférieurs.

Le corps de ce poisson est, à létat frais, d'un jaune verdâtre pâle, tirant au brunâtre, et passant sur les parties inférieures au blanchâtre. On voit, sur la moitié supérieure du corps, des taches nuageuses d'un noirâtre pàle, assez larges et serrées; elles sont très larges mais peu apparentes sur la tête. L'iris de l'aeil est grisâtre. Les pectorales et la caudale sont d'un jaune orangé pâle, et cette dernière nageoire est ornée de traits bruns disposés par séries transversales. On remarque des traits semblables sur les rayons des dorsales, dont la couleur est jaunâtre, tandis que les membranes de ces nageoires sont d'un-grisâtre pâle. Les membranes de la ventrale et de l'anale offrent également cette dernière teinte, mais leurs rayons sont d'un blanc rougeâtre.

Cette espèce parvient à une taille de huit à douze pouces. Son nom japonais est Okihaze. Elle est commune à l'embouchure des fleuves qui se jettent dans la baie de Nagasaki. On la prend le plus souvent lorsque le temps est à la pluie. On la mange.

Description: D. VIII or IX, 1–12 to 14; A. I–11; V. I–5, Sq. 1, 55 to 65; tr. a. 14 to 18; tr. b. 20 to 28; tr. c. 9 to 13; pred. 25 to 30.

Body elongate, somewaht cylindrical anteriorly; the caudal peduncle compressed. Head large; snout rather blunt. Eyes small, high up, directed obliquely; interorbital space concave; distance between eyes less than their diameter. Mouth very large, oblique; jaws equal; lips broad; maxillary concealed, extending to a vertical through anterior part of pupil. Tongue broad, truncate, with but a narrow free margin. Teeth simple, small, in narrow bands on both jaws. Anterior nostrils with low rims. No barbels. Gill openings not extending far forward; the isthmus broad, its width about equal to $1\,^1/_2$ times diameter of eye. Inner edge of shoulder girdle with a narrow ridge. but no papille. Gill-rakers on first arch $3+9$, short, rather thick.

Head with scales on upper parts of opercles and cheeks, and on occiput; those on cheeks small, round, difficult to detect. Body completely covered with large ctenoid scales, except on nape and breast, where they are small and cycloid; those of breast minute.

Dorsals separate, the spines slender, when depressed reaching insertion of second dorsal. Anal inserted below base of third or fourth dorsal rays, when depressed reaching posteriorly about as far as the dorsal, both touching base of caudal. Pectorals and caudal pointed or acutely rounded; upper edge of the former without filaments. Ventrals large; free posteriorly.

Color light yellowish olive; dusky above; sides with 5 very indistinct spots; snout rather darker than body. Dorsals with dusky spots arranged in oblique rows; upper two-thirds of caudal with zigzag dusky bands; the lower third of fin plain dusky; pectorals with a little dark color at base; ventrals and anal with some dark color.

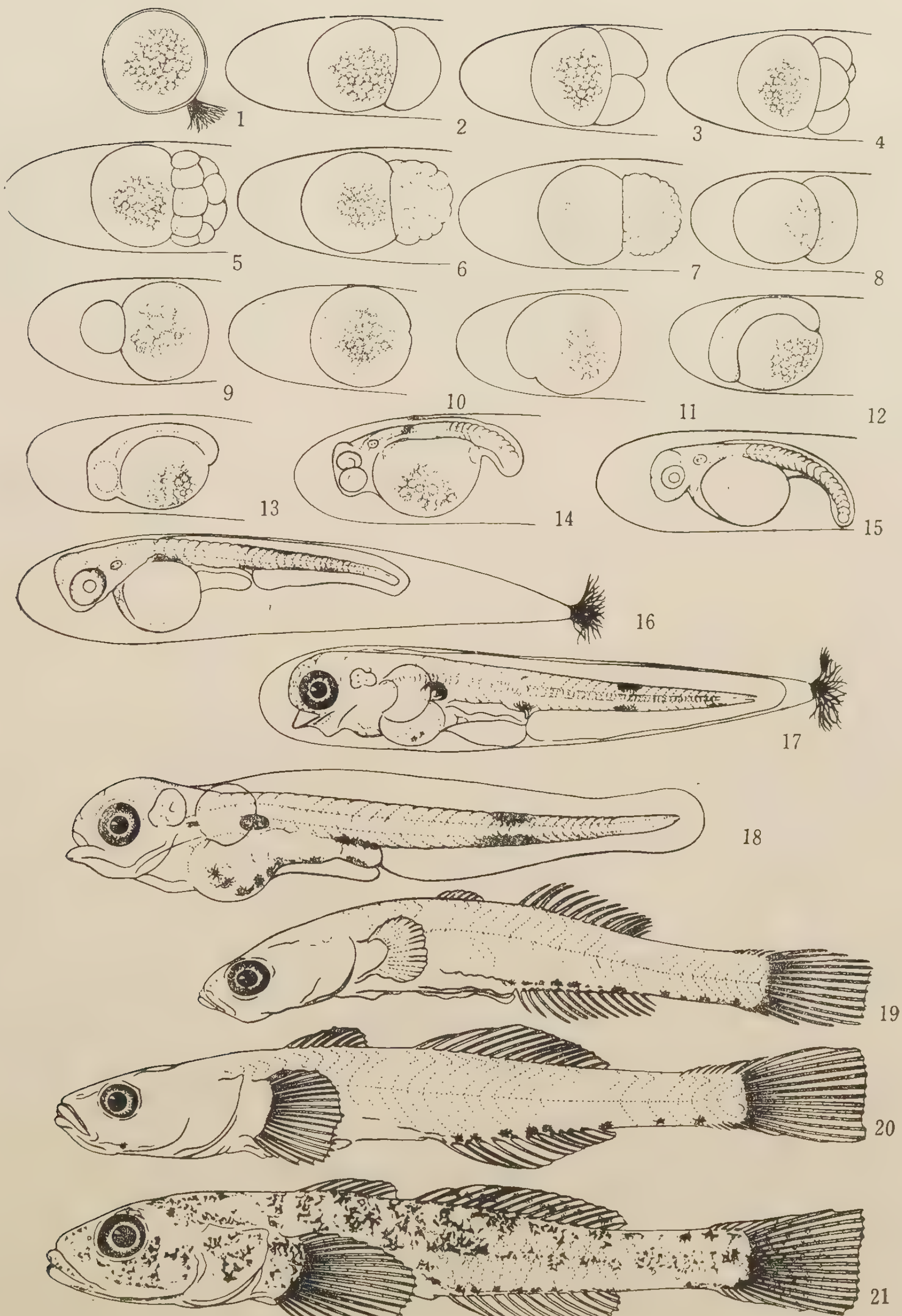
Habits: The present species may mature after one year. The breeding season occurs on February and March. The eggs are deposited under sand or muddy bottom of shallow water. The adults mostly live in brakish water around mouth of river and sometimes enter into lakes and swamps along sea coast and also into rivers. Youngs are liv-

PLATE LVII

Development of ***Acanthogobius flavimanus*** (T. et Sch.), after Y. Dotu, (1955).

1. Unfertilized egg.
2. Fertilized egg before segmentation, 3°30' after fertilization.
3. 2 cell stage, 4°30' after fertilization.
4. 4 cell stage, 6° after fertilization.
5. 8 cell stage, 8°30′ after ferlilization.
6. Morula stage, 9°40' after fertilization.
7. Blastula stage, 14°10 after fertilization.
8. Blastoderm covers 1/3 of yolk.
9. Blastpore becomes narrow, leaving a position of yolk outside.
10. Blastopore closed, 2 days after fertilization.
11. Early embryo formed, 2 days and 12° after fertilization.
12. Optic vesicle formed, 3 days and 12° after fertilization.
13. Kupffer's vesicle appears, 4 days and 12° after fertilization.
14. Otocyst appears, 7 days and 12° after fertilization.
15. Heart begins to pulsate, 10 days and 12° after fertilizatoin.
16. Embryo 13 days after fertilization.
17. Embryo just beofore hatching, 28 days after fertilization.
18. Newly hatched larva, 4. 6 mm. in total length.
19. Larva with ventral fin, 12. 1 mm. in total length.
20. Juvenile 16. 6 mm in total length, end of the pelagic life.
21. Juvenile, 17.6 mm in total length, early bottom life.

PLATE LVII



ing in the mouth of rivers making groups and when the water temperature goes down on the end of autumn, they descends into sea. Foods are small fishes and crustaceans.

Type locality: Nagasaki.

Distribution: Aomori to Kagoshima (TOMIYAMA); Rikuzen; Yachigo; Hokkaidô; Tôkyô; Wakanoura, Kii; Hakodate; Onomichi; Kurume; Nagasaki; Misaki; Matsushima; Aomori; Tsuruga; Enoshima; Niigata; River Yodo, Ôsaka (JORDAN & SNYDER); Shimoda (GILL); Hachirôgata, Minami Akitagun, Akita Prefecture; River Arao, Tamatsukiri-gun, Miyagi Prefecture; Miyagi-gun, Miyagi Prefecture; Matsushima Bay, Miyagi Prefecture; Tsuruoka, Yamagata Prefecture; River Hyuga, Yamagata Prefecture (OKADA & IKEDA); Misaki (AOKI); Tôkyô market; River Kachi, Nagoya (JORDAN); Toba (JORDAN & YAMAMOTO); Kumamoto (WAKIYA); Mikawa Bay (ISHIKAWA); Himeji (ABE); Toyama (YOSHIZAWA); Lake Biwa (JORDAN); Fukuoka (HAMADA); Fukui (NONAKA); Noo, Niigata Prefecture; Lake Kasumigaura (HATTORI); Wakayama Prefecture (UI); Shimonoseki; Ôsaka; Kôbe; Misaki; Matsushima; Nagoya (JORDAN & THOMPSON); Hokkaidô (ISHIKAWA & OSHIMA); River Kumozu, Tsu City, Mie Prefecture (OKADA & KUBOTA); Morioka, Iwate Prefecture (KOYAMA).

Remarks: According to the report on the breeding habits of *Acanthogobius flavimanus*, made by Y. DOTU and S. MITO in 1955, the spawning season extends from January to March in Kyûshû. The breeding room somewhat flat Y-shaped with two entrances, is making vertically in the tidal flat deposit. Eggs are club-shaped, 5.5 mm. × 0.95. mm. in size, with adhesive filaments around the basal end, attached to the wall of the upper part of the room. The incubation-period extends about 28 days under the water temperature about 13°C. The newly hatched larva is about 4.6 mm. in total length. The larvae, 4.9–12.0 mm. in size, spend a pelagic life in the bay while the youngs of 15–20 mm. in size move to bottom of estuaries. The food is mostly consisting of planktonic copepods.

114. Acanthogobius hasta (TEMMINCK et SCHLEGEL).
"Hazekuchi"
(Text-fig. 115)

Gobius hasta TEMMINCK et SCHLEGEL, 1845, Faun. Japon. Poiss., p. 144, pl. 75, fig. 1 – GÜNTHER, 1861, Cat. Fishes, III, p. 78.

Gobius ommaturus RICHARDSON, 1845, p. 146, pl. 55, figs. 1-3. JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. XXIV, no. 1244, p. 102.

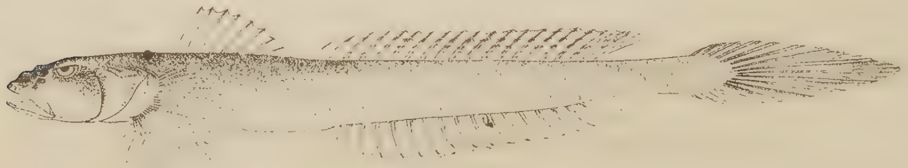
Acanthogobius hasta – JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Jap., p. 356. - Tomiyama, 1936, Jap. Journ. Zool., vol. VII, no. 1, p. 85. – AOYAGI, 1957, Gen. Notes Freshwater Fish. Jap. Arch., p. 236.

The original description* is as follows:

Gobius hasta Pl. LXXV, fig. 1. Remarquable par ses formes très-alongées, cette nouvelle espèce surpasse même, sous ce rapport, le *Gobius lanceolatus* et les espèces voisines. Elle a le corps tellement effile que sa hauteur ne fait qule le douzième de la longueur totale du poisson; la tête entre environ six fois dans cette longueur, et le museau occupe un peu plus du tiers de la longueur de la tête. Le corps devient assez grêle vers les parties postérieures, de sorte que le lobe libre de la queue n' offre au milieu que la moitié de la circonférence du corps près des pectorales. Les yeux sont de grandeur moyenne et l'entre-deux des yeux égale leur diamètre. Les bords supérieur et postérieur des orbites sont saillants et forment un angle un peu obtus. Le dessus du museau est également pourvu de trois lignes saillantes, que se prolongent jusque vers l'intermaxillaire. Il existe de chaque côté du museau un orifice, précédé d'un petit tubercule mou, qui ne parait pas être percé d'un trou. La ligne du dessus du museau est inégale et un peu courbée notamment vers le devant. La bouche est fendue jusque sous l'aplomb du bord antérieur de l'oeil; elle est garnie d'une bande très-étroite de dents, dont celles de la rangée extérieure sont beaucoup plus grandes et plus aiguës que celle de la rangée intérieure. Les écailles sont peu grandes. La ligne latérale est peu apparente; elle parait être droite dans toute sa longueur. Les pectorales, de grandeur moyenne, sont de forme lancéolée et assez larges à la base. La ventrale est en forme de coeur. La dorsale épineuse commence un peu derrière l'aplomb de l'aiselle des pectorales; sa hauteur égale deux tiers du diamètre du tronc; elle diminue peu à peu en hauteur vers le derrière, mais en sorte que sa ligne supérieure fait une courbure assez régulière; son dernier rayon est de moitié plus court que les deux premiers. La deuxième dorsale nait derrière la première, à une distance égale au diamètre du lobe de la queue; elle est plus basse que la dorsale épineuse, mais assez longue et partout d'égale hauteur. L'anale répond par sa forme à cette seconde dorsale; elle s'étend presque autant vers le derrière que cette nageoire, mais elle ne commence que sous l'aplomb du troisième rayon de la dorsale molle. La caudale, aussi longue que la tête, offre une forme assez effilée et lancéolée; ses petits rayons latéraux se prolongent sur la queue tant en dessus qu'en dessous. D. 8 et 20; A. 17; V. 10; P. 22; C. 26.

A l'état frais, la teinte générale est un brun verdâtre, foncé sur le dos, plus clair sur les flancs, passant au bleuâtre sur le ventre et au brun rougeâtre sur le bas des joues, sur les pectorales et sur les parties inférieures de l'anale et de la caudale. Cette dernière nageoire est beaucoup plus toncée que les autres parties durcorps, et la dorsale molle est ornée de quatre rangées de petits traits noirâtres. L'iris de l'oeil est verdâtre.

L'individu qui a servi de modèle à notre figure, est le seul que nous ayons recu de cette espèce; il est long à peu près de dix pouces.



Text-fig. 115. ***Acanthogobius hasta*** (TEMMINCK et SCHLEGEL).

Description: Head $5\,^1/_4$ in length; depth 10; D. VIII–20; A. 17; p. 22.

Body very elongate; caudal peduncle long and slender. Eyes small; high up; interorbital width equal to vertical diameter of eye. Snout rather long; pointed; jaws equal; mouth small, oblique. Maxillary extending to a vertical through anterior edge of orbit.

*TEMMINCK et SCHLEGEL, 1845, Fauna Japonica Poisson, p. 144, pl. 75, fig. 1.

Teeth in bands, the outer ones slightly enlarged. Head naked; no barbels. Body with rather large scales.

Dorsals separate; the spines slender, their tips filamentous; when depressed not reaching insertion of soft dorsal. Anal inserted below base of fourth dorsal ray; when depressed, reaching about as far posteriorly as does the dorsal, neither fin touching base of caudal. Caudal pointed. Pectoral pointed; its upper edge without filaments, Ventrals free posteriorly.

Color brownish green; pectoral, anal, and lower part of caudal suffused with brownish red; soft dorsal with elongate dusky spots in longitudinal rows. (on account of JORDAN and SNYDER's description 1901, p. 102).

Type locality: Japan.

Habits: The present species lives in the lower stream of rivers and sometimes in brakish waters.

Distribution: Ariake Sound, Yatsushiro Sound, Kyûshû (TOMIYAMA); Nagasaki (JORDAN, TANAKA & SNYDER); Formosa (OSHIMA).

Genus **Chaenogobius** GILL, 1862.

Chaenogobius GILL, 1862, Ann. Lyc. Nat. Hist. N. Y., p. 12.
Type .... **Gobius annularis** GILL

Characters: Body rather elongate; the head broad and depressed anteriorly; mouth large, oblique; the lower jaw projecting; teeth moderate, in bands; tongue emarginate; sides of head naked; no barbels; eyes well separated; isthmus very narrow; the gill opening continued forward below. Scales very small, cycloid or weakly ctenoid; dorsal fins short, the first of 6 slender spines; ventrals moderate, not adnate; caudal short.

Key to Japanese species of Genus Chaenogobius

a¹ Angle of glossopharyngeal bone 65°; height ratio of caudal peduncle 0.081~0.102. .... **Ch. annularis urotaenia**

a² Angle of glossopharyngeal bone 45°; height ratio of caudal peduncle 0.061~0.081.

- b¹ Dorsal surface of tongue smooth; head scaled; posterior end of upper jaw not reaches the posterior margin of pupil .... **Ch. annularis annularis**
- b² Dorsal surface of tongue densely tuberculated; head without scale; posterior end of upper jaw far beyond the posterior margin of pupil .... **Ch. isaza**

115. **Chaenogobius annularis annularis** (GILL).

"Biringo"

(PL. LVIII, figs. 1–9)

Gobius annularis GILL, 1859, Ann. Lyc. Nat. Hist. N. Y., p. 12.
Gobius castaneus O'SHANGHNESSY, 1875, Ann. Mag. Nat. Hist., XV, p. 145.
Gobius laevis STEINDACHNER, 1879, Ichth. Beitr., VIII, p. 22.
Gobius breunigii, STEINDACHNER, 1879, Ichth. Beitr. VIII, p. 22.
Chaenogobius annularis annularis, JORDAN et SNYDER, 1901, Pre. Check List, Fish. Jap., p. 113. - TOMIYAMA, 1936, Jap. Jour. Zool., VII, p. 90. – OKADA et IKEDA, 1938, Rep. Tokyô Bun. Daig. Sect. B. no. 55, p. 153. – OKADA et IKEDA, 1938, Saito Hô-onkai Mus., Resear. Bull., no. 15, pp. 117–118.
Chloea senbae TANAKA, 1916, Zool. Mag. Tokyô, XXVII, p. 228.
Chaenogobius annularis, JORDAN, TANAKA et SNYDER, 1913, Cat. Fish Jap., p. 350. OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, pp. 204–205, fig. 129. – AOYAGI, 1958, Gen Notes Freshwater. Fish. Jap. Arch., pp. 240-241, fig. 194.
Chloea nakamurae JORDAN et RICHARDSON, 1907, p. 265, fig. 13.

The original description* is as follows:

Chaenogobius annularis, GILL.

Corpus antice fere cylindricum, altitudine ad pinnam dorsalem maximo, non extermi longitudinis partem septimam aequante, duplice quam caudae altitudo; postice compressum.

Linea ab pinna dorsali ad rostrum fere recta.

Caput laeve, lateraliter semiconicum, infra pene horizontale; superne latior, depressum planumque, lente ad rostrum rotundatum coarctatum. Nucha paulo constricta.

Capitis longitudo rostro ad operculi marginem non longitudinis partem quartam formans (23–100); altitudine ejusdem fere dimidio (11–23); latitudine prope uncham multo dimidium saperante (13–23).

Oculi omnino in capitis parte anteriore, orbitae diametro fere quarties in capitis longitudine; spatio interorbitali diametri 3/5 aequante.

Pinna caudalis parva, rotundata, circa longitudinis partem sextam formans. P. dorsalis prima radiis sex, ultimo remotiori; p. dorsalis secunda longitudinis dimidio posteriori incipiens.

D. VI. 9. A. 8. C. 19.

Prodromus Descriptionis Subfamiliae Gobinarum

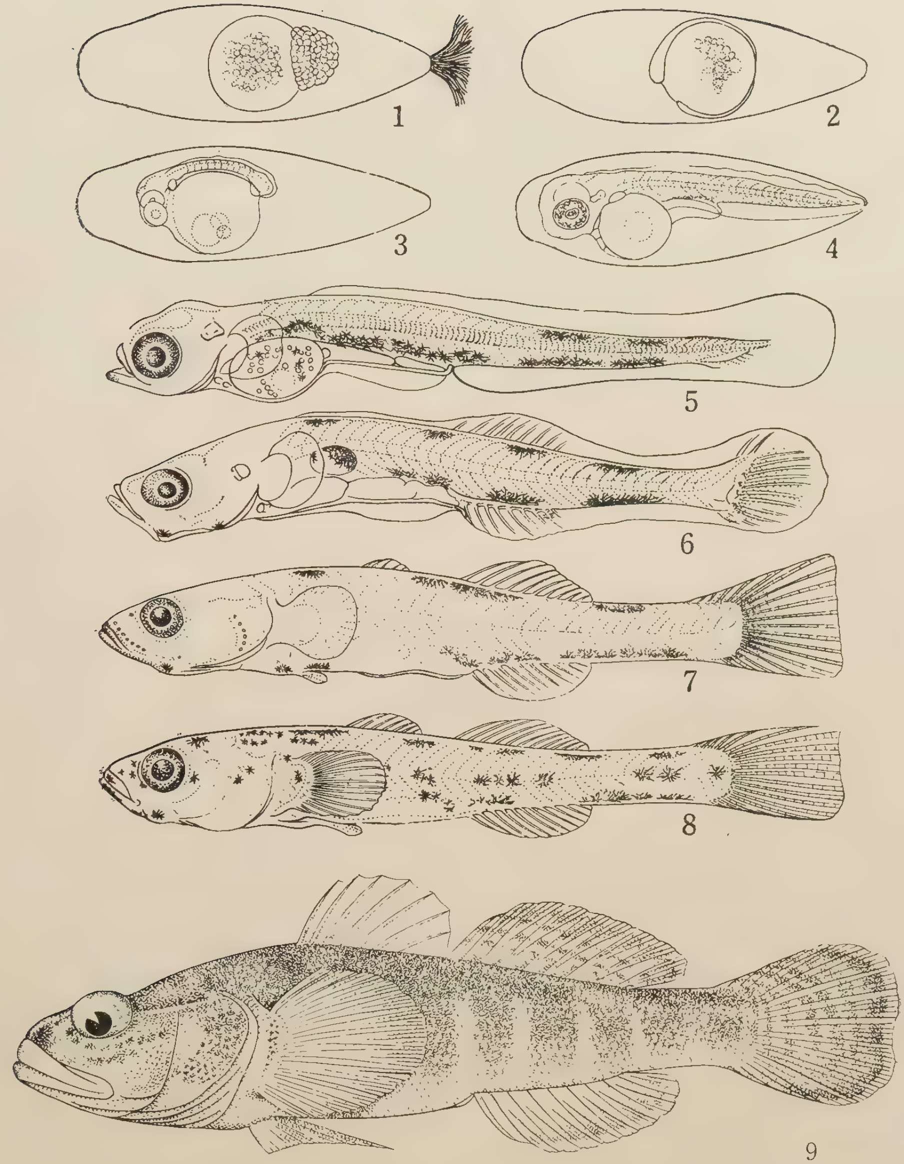
Color fulvus, supra dense guttulis nigricantibus minimis obscuratus, lateribus pone anum paucibus annulis fere mundis ocellos formantibus. Venter fere mundus, fulvus. Pinna dorsalis secunda trifasciata.

Hab. in sinu "Hakodadi" insulae Japonicae "Jesso." W. STIMPSON! (specimen unicum).

Description: Body cylindrical anteriorly; caudal peduncle narrow, somewhat compressed. Head broader than deep. Eye of medium size, located anteriorly, directed almost laterally; 4 in head; interorbital space three-fifths diameter of eye. Mouth somewhat oblique, jaws equal. Maxillary exposed at its posterior end only, reaching a vertical between anterior edge of orbit and pupil. Teeth villiform, in narrow bands on both jaws, the outer ones of lower jaw slightly enlarged. Tongue notched anteriorly. Head naked except on occiput, where there are small cycloid scales.

*GILL, 1859, Ann. Lyc. Nat. Hist., 1859, vol. VII, pp. 13–14.

PLATE LVIII



Development of ***Chaenogobius annularis annularis*** (***Chaenogobius castanea***), after Y. Dôtu (1954).

1. Morula stage.
2. Early embryo.
3. Embryo with Kupffer's vesicle.
4. Advanced embryo
5. Newly hatched larva, 7. 8 mm. in total length.
6. Post-larva, 9. 7 mm. in total length.
7. Post-larva, 15. 2 mm. in total length
8. Juvenile, 10. 5-11.mm. in total length, with well-developed dorsal fins.
9. Adult.

Dorsal fins separate, the spines almost as high as the rays. Anal inserted below base of second or third dorsal rays; the rays equal in height to the dorsal spines, the depressed fin reaching a little further posteriorly than does the dorsal, both falling considerably short of base of caudal. Caudal rounded; pectoral without filaments on upper edge; round posteriorly. Ventral rather short and broad.

Color brownish; dotted above with blackish; several ocellate spots about the vent; second dorsal with 3 bands.

Habits: The present species is distributed in whole of Japan. They are dwelling in ponds and swamps located in the plain and swimming in the middle layer of water instead of bottom as seen in common *Gobius*. They are freeding on small pelagic crustaceans and micro-algae. They breed during the end of April and the end of July, and deposit eggs or stems of water plant on woods in water.

Type locality: Hakodate, Hokkaidô.

Distribution: Hakodate, Hokkaidô (GILL); Nagasaki (O'SHAUGHNESSY); Hakodate, Hokkaidô (STEINDACHNER); Senbanuma, Mito, Ibaraki Minami-Akita-gun, Akita Prefecture; Izu-numa, Kurihara-gun, Miyagi Prefecture; Okada-bori, Shichigo-mura, Miyagi Prefecture; River Hyûga, Yamagata Prefecture (OKADA & IKEDA); Hakodate (JORDAN, TANAKA & SNYDER); Hakodate to Nagasaki Prefecture (TOMIYAMA); River Ishikari, Hokkaidô (SH. OKADA); Lake Abashiri, Ônuma Hokkaidô (OKADA & AOYAGI); Tsu, Mie Prefecture (OKADA & KUBOTA); Mano, Sado (OSHIMA); River Yahagi, Aichi Prefecture (HASUMOTO); River Kitami; Morioka, Iwate Prefecture (KOYAMA).

Remarks: TOMIYAMA[1)] noted the specimens on hand exhibit many variations in characters, especially in the form of body which varies in the specimens not only collected from different localities but also from the same locality at the same time, and in the squamation and in coloration.

In 1950, DOTU, YOSIE studied the life history of *Chaenogobius castanea* O'SHANGHNESSY (*Chaenogobius annularis* HILGENDORF), around Fukuoka City, Kyûshû. According to his description, the present species is very common in estuaries and shores of Japan, where it passes the whole period of the life history. It exhibits many local variations of external features. The spawning season occurs during January and April. Before spawning, the mature male prepares a room for breeding, usually utilizing a vacant nest of *Urogebia major* DE. HAAN, distributed widely in shallow sandy bottom of estuary. The eggs are deposited on the inner wall of the hole, measuring about 1 cm. in diameter and 5–10 cm. deep. The female leaks soon the nest after spawning, while the male there guarding the eggs until they hatch out. The egg is rather large, club-shaped, measured 4.1 mm. in long and 1.3 mm. broad. Newly hatched larva is 7.8 mm. in size. Advanced larvae, 10–16 mm. in total length, spend pelagic life in the bay, feeding on small crustaceans as Copepods. Juvenile of 20 mm. in size commences a bottom-life when the feeding habits changes into omnivorous one.

1). TOMIYAMA, I; 1936, Jap. Journ. Zool., vol. VII, no. 1, pp. 90-91.

Many specimens obtained around Fukuoka City, Kyûshû, show the male to grow 37–51 mm. total length in lst year, 49–55mm. in 2nd year and over 55mm. in 3rd years, while the female to 40–56mm. in lst year, 56–64 mm. in 2nd year and over 64 mm. in 3rd year.

116. Chaenogobius annularis urotaenia (HILGENDORF).

"Ukigori"

(Text-fig. 116)

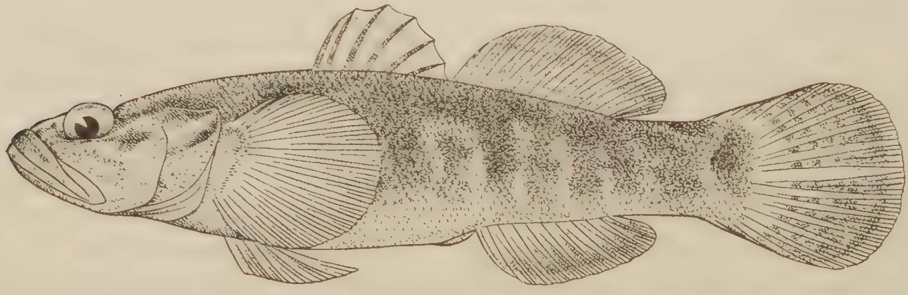
Gobius urotaenia HILGENDORF, 1879, Sitzber. Nat. Freunde, Berlin, p. 108.

Aboma urotaenia JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. XXIV, no. 1244, p. 71.

Chaenogobius urotaenia, TOMIYAMA, 1936, Jap. Journ. Zool., vol. VII, no. 1, p. 91, fig. 38. - OKADA et IKEDA, 1938, Sci. Rep. Tokyô Bun. Daig. Sec. B., no. 55, p. 153. - OKADA et IKEDA, 1938, Saito Ho-on kai Mus., Resear, Bull., no. 15, pp. 118–119. - OKADA et NAKAMURA, 1948, Nihon Tansui-gyorui, pp. 205-206, fig. 140. -AOYAGI, 1958, Gen. Notes Freshwater Fish. Jap.Arch., pp. 241–242, fig. 195.

Chaenogobius macrognathus JORDAN et SNYDER, 1901, Pre. Check List. Fish. Jap., p. 76, fig. 3 - JORDAN et THOMPSON, 1914. Mem. Carn. Mus., vol. VI, no. 4, p. 288. - JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Jap., p. 350, fig. 302. - JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. X, no. 2, p. 307. - OKADA, UCHIDA et MATSUBARA, 1935, Nihon Gyorui Zusetsu, p. 228, pl. 133, fig. 1. - MIYAJI, 1935, Kyôtofuka Tansuigyo, p. 44, pl. t, fig. 45 - MIYADI, 1935, Shinsyu Gyorui, pp. 230–231, figs. 135–136.

Chloea aino SCHMIDT, 1904, Mem. Carn. Mus., vol. VI, p. 56, fig. 53.



Text-fig. 116. ***Chaenogobius annularis urotaenia*** (HILGENDORF).

The original description* is as follows:

Gobius urotaenia HILGENDORF, 1879.

D. 9 (7) 12-13, A. 12–13, L. tr. (Zwischen D. II und A.) 20.

Körperhöe in Länge 5½ mal, Kopfl. in Körperl. 3⅔ mal, Köpfhöhe in Kopfl. 2 mal, Kopfdicke in Köpfhöhe ¾ mal; Augen durchm kaum unter Schnanzenl., in postorbitalen kopftheil 2½ mal; Interorbitalbreite fast gleich dem vertikalen Augendurchm; Unterkiefer vorstehend; Kopfprofil sehr schwach convex. Kopf unbeschuppt. Körperschuppen mit etwa 7–9 entfernstehenden Stacheln am Hin-

*HILGENDORF, 1879, Sitzber. Naturf. Freunde, pp. 107–108.

terrand. Zähne oben und unten in mehreren Reihen, von denen die äussere grössere Zähne trät. Ruckenflossen nicht verlängert.

Farbe hellbraun mit unregelmässigen dunkleren Flecken, die längs den Schwanzseiten meist rhombische Form annehmen und vor der C. in einen deutlichen Fleckendigen; die obere wie die untere Mittellinie des Schwanzes mit dunklen Strich; vor dem Auge ein horizontaler Streif; die Schwanzflosse ist in ihrer Mitte von einen einfachen stets wohl ansgebildeten Querbinde durchsetzt, der eine undeutliche gegen den Saum zu folgt; D. I. mit einer, D. II mit zwei dunklen Binden.

Nur kleine Exemplare bis 37 Mm. Länge, wurden gesammelt, Mus, Ber, No. 10644.

Description: D. VI or VII, 1–10 or 11 rarely 12; A. 1–10 or 11; V. 1–5. Sq. 1.75 to 90; tr. a. 20 to 25; tr. 6.25 to 35; tr. c. 17 to 20; pred. 25 to 35.

Eye 4.5 in head, scarcely less than snout; depth of head 2 in head, breadth 2.3; interorbital width equal to vertical diameter of eye; lower jaw projecting; teeth in several rows, the outer larger; rays of dorsal not produced; profile of head very weakly convex; head scaleless; scales of body ctenoid, each with 7 to 9 teeth on the edge.

Color clear brown, with irregular darker spots, those along lateral line mostly rhombic, a distinct spot at base of caudal; a horizontal streak before eye; a dark streak along caudal peduncle above and below; caudal with a well-marked median cross band constantly present; a fainter band near the edge. Spinous dorsal with one, anal with two, distinct bands.

Habits: The present species is very common distributed widely, in freshwaters from Hokkaidô to Kyûshû. In the Biwa lake, it dwells in shallow waters and spawns during

Table 120. Measurements of *Chaenogobius annularis urotaenia* (Hilgendorf).

Collection	O. H. B. S.*		
Total length	106.0mm.	98.0mm.	84.0mm.
Body length	88.5	81.0	69.0
Body length/Head	3.27	3.02	3.04
Body length/Depth	5.50	5.67	5.68
Body length/Predorsal length	2.48	2.35	2.44
Body length/Prepectoral length	3.16	2.80	3.06
Body length/Preventral length	3.16	2.84	3.13
Body length/Preanal length	1.55	1.47	1.53
Head/Snout	3.55	3.44	4.40
Head/Upper jaw	1.93	1.89	2.09
Head/Interorbital width	4.28	4.32	4.78
Head/Diameter of Eye	7.50	6.70	6.95
Head/Length of Caudal peduncle	1.57	1.98	2.06
Head/Depth of Caudal peduncle	2.91	3.08	2.82
Head/Length of Dorsal fin I	2.03	2.19	2.82
Head/Length of Dorsal fin II	1.63	1.78	2.37
Head/Length of Anal fin	2.25	2.18	2.40
Head/Height of Dorsal fin I	3.00	2.92	2.47
Head/Height of Dorsal fin II	2.16	2.60	2.16
Head/Height of Anal fin	2.08	2.35	2.06
Head/Pectoral length	1.45	1.47	1.35
Head/Ventral length	1.80	1.88	1.74
Date	X, 1928		
Locality	Hokkaidô		

*Otsu Hydrobiological Station attached to Kyôto University.

May to June. The eggs are deposited on stems of water plants around shallow water. The youngs are swimming in group while the adults are frequently in solitary. They are distributing widely in rivers, lakes and swamps of Japan, not ascending to the upper stream, and like to stay on muddy bottom of pragnant waters. During winter, they go down into deep of rivers and lakes to winter there. They feed on freshwater fishes, pelagic crustaceans and shrimps as well as worm.

Type locality: Tôkyô.

Distribution: Tôkyô (HILGENDORF); Hunaki, Shiga Prefecture; Kurume, Kyûshû; Aomori; Tôkyô; Tsuruga; Kyotofu; Chitose, Hokkaidô; Matsubara, Shiga Prefecture; Same, Aomori Prefecture; Gifu, Gifu Prefecture; Nagoya, Aichi Prefecture (JORDAN & SNYDER); Hidaka, Hokkaidô; Kawanabe, Kagoshima Prefecture (TOMIYAMA). Bay of Tôkyô (JORDAN & SNYDER); Lake Ônuma; Lake Abashiri, Hokkaidô (OKADA & IKEDA); River Iwate, Yamagata Prefecture (OKADA & IKEDA); Misaki, Kanagawa Prefecture; Yokohama (JORDAN & THOMPSON); Amamioshima; River Yodo, Kyôtô (JORDAN); Yamawa, Kagoshima Bay, Kagoshima Prefecture; Kumamoto Prefecture (WAKIYA); Himeji, Hyogo Prefecture (ABE); Aomori Prefecture (BEPPU); Lake Biwa, Otsu, Shiga Prefecture (JORDAN & KAWAMURA); Lake Hakone (JORDAN); Lake Kasumigaura (HATTORI); Yamaguchi Prefecture (JORDAN & HUBBS); Matsubara, Iba, Lake Biwa (TANAKA); Chipesani, Loscosei Bay, Lake Busse, Sakhalin (TANAKA); Kunishiro Island, Kuril Island (MIYADI); Amamioshima (JORDAN & TANAKA); Koshikijima Rettô, Kyûshû (OGAWA); Kurosawajiri, Morioka, Iwate Prefecture (KOYAMA).

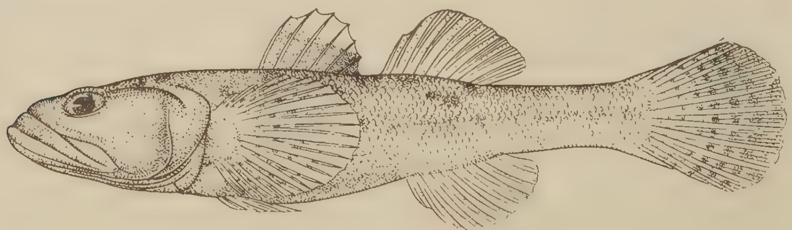
117. Chaenogobius isaza TANAKA.

"Isaza"

(Text-fig. 117)

Chaenogobius isaza TANAKA, 1916, Zool. Mag., vol. 28, no. 327, pp. 102-103. – MIYADI, 1935, Kyôtofuka Tansuigyo, p. 44. – OKADA, UCHIDA et MATSUBARA, 1935, Nihon Gyorui Zusetsu, p. 227, pl. 132, fig. 3. OKADA et NAKAMURA, 1948, Nihon Tansuigyo, p. 206, fig. 141.

Chaenogobius castaneus TANAKA, 1908, Ann. Zool. Jap., vol. VII, pt. 1, p. 10.



Text-fig. 117. ***Chaenogobius isaza*** TANAKA

The original description* (in Japanese) is as follows:

Chaenogobius isaza, n. sp

"Isaza" (Lake Biwa) (Gobiidae)

Body (except caudal fin) 3 times of head in length; 6 times of height.

Head length $4^1/_4$ of eye, $5^2/_3$ of interorbital space; $3^7/_9$ of snout length; $2^1/_8$ of mandible; $4^1/_4$ caudal peduncle. Scales ctenoid, arranged 60 oblique lines; 18 on a line. Naked on dorsal side anterorly from first dorsal fin and on ventral side; fewer around pectoral fin. 1st dorsal 103, VI; i2nd dorsal 11; pectoral 18 and caudal 9 branched fin rays. Tongue notched; vomer without teeth. Ventral fin united bilaterally, plate-like, not connected to body with membrane. Head broader than height; somewhat compressed on upper. Body compressed laterally. Color in formalin light yellow, mottled with brown spots. Ventral white, pale. Somewhat distinct transverse bands running on fins except ventral. Caudal with few transverse bands.

Type locality: Lake Biwa. Collected by the Fisheries Experiment Station of Shiga Prefecture.

About 6 cm. long, from head to end of caudal fin.

Table 121. Measurement of *Chaenogobius isaza* TANAKA.

Collection	O. H. B. S.*		
Total length	64. 0mm.	58. 0mm.	66. 0mm.
Body length	55. 0	48. 0	54. 0
Body length/Head	3. 24	3. 00	3. 27
Body length/Depth	6. 25	5. 72	6. 45
Body length/Predorsal length	2. 62	2. 18	2. 45
Body length/Prepectoral length	3. 33	3. 10	3. 18
Body length/Preventral length	3. 43	3. 04	3. 27
Body length/Preanal length	1. 69	1. 63	1. 61
Head/Snout	3. 40	3. 56	3. 30
Head/Upper jaw	2. 00	1. 85	1. 94
Head/Interorbital width	8. 50	8. 00	7. 50
Head/Diameter of Eye	4. 87	4. 58	4. 47
Head/Length of Caudal peduncle	1. 27	1. 28	1. 21
Head/Depth of Caudal peduncle	3. 78	3. 82	3. 94
Head/Length of Dorsal fin I	3. 09	2. 92	2. 75
Head/Length of Dorsal fin II	1. 93	1. 91	1. 80
Head/Length of Anal fin	1. 93	1. 78	1. 79
Head/Height of Dorsal fin I	2. 27	2. 14	2. 18
Head/Height of Dorsal fin II	1. 93	1. 88	1. 84
Head/Height of Anal fin	2. 18	2. 11	2. 06
Head/Pectoral length	1. 42	1. 26	1. 32
Head/Ventral length	1. 89	1. 69	1. 72
Date	I, 1916		
Locality	Lake Biwa, Shiga Prefecture		

*Otsu Hydrobiological Station attached to Kyôto University.

Habits: The present species is mostly found in Lake Biwa and rivers connected to it. It is dwelling in the bottom of lake, about below 30 meter deep and migrates to shallow waters in spring time. It spawns during May and June and deposits 1,300–2,300 eggs in Spring time.

*TANAKA, SH., 1916: Zool. Mag., vol. 28, no. 327, pp. 102–103. (in Japanese).

According to SH. KOBAYASHI[1] who has investigated the ecology of *Chaenogobius isaza* during 1939–1948 years in Lake Biwa, Shiga Prefecture, the total catching of every year fluctuates greatly by rather dense population extending from shallow water to the deep of 30 meters. During daytime, it lives on muddy deeper bottom than 30 meters while at night it comes up near the water surface. In the spawning season from April to May, they migrate into shallow water where their eggs are deposited under pebbles. The number of eggs are variable arranging from 1,300 to 2,300. The sexual difference is remarkable during breeding season. The female shows a yellow stripes on the side of belly. The genital papillae of female is big, flat, rounded at end while that of male is slender, triangular and pointed at end. Eggs are protecting by male after deposition and they hatch out 115 hours after fertilization under the water temperatures of 15–23°.

Distribution: Kyôtô, Lake Biwa (MIYADI); Momose, Funaki, Lake Biwa (TANAKA).

Remarks: MIYADI[2] has noted that the present species may be a young of *Chaenogobius annularis urotaenia* (HILGENDORF) and *Chaenogobius macrognathus* (BLEEKER) on account of recent investigation.

Genus Leucopsarion HILGENDORF, 1880.

Leucopsarion HILGENDORF, 1880, Berliner Monatober, p. 339.
Type ········ **Leucopsarion petersi**

Characters: Body elongate, compressed, scaleless, the substance translucent; head short, depressed above; the cheeks little tumid; the eyes prominent; mouth rather large, terminal, oblique; teeth simple; no barbels; tongue notched; isthmus narrow, the gill openings continued forward below. Spinous dorsal wanting; soft dorsal moderate, well separated from the short caudal; anal longer than the soft dorsal and inserted well in advance of latter; pectorals rather long; ventrals very small, fully united, forming a rounded scale-shaped disk, the rays obscure; the structure seems exactly as in *Gobius*, but the fin much less developed.

118. Leucopsarion petersi HILGENDORF.

"Shirouwo, Gyafu"

(PL. LIX, figs. 1–20)

Leucopsarion petersi HILGENDORF, 1880, Berliner Monatsber., p. 340. – JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. xxiv, no. 1244, pp. 125–126, fig. 31. – KITAHARA, 1904, Ann. Zool. Jap., vol. 5, pt. 3, pp. 113–115, pl. 5. – JORDAN, TANAKA et SNYDER, 1913, Cat. Fish. Jap., p. 363, fig.

1). KOBAYASHI, SH. & YAMANAKA, YUTARO, 1950, Shigaken Suisan Shikenjô Kenkyû Hôkoku, No. 1, pp. 1–8, pl. I, fig. 1, tables 1–5. (in Japanese).
2). MIYADI, 1935, Kyôtofuka Tansuigyo, p. 44.

319. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. vi, no. 4, p. 291, fig. 65. – JORDAN et HUBBS, 1925, Mem. Carn. Mus., vol. x, no. 2, p. 310. – UI, 1932, Kisyugyofu, p. 250, pl. 5, fig. 46. – KAMOHARA, 1931, Zool. Mag., 34 (508), p. 94. – MIYADI, 1935, Kyotofu Tansuigyo, pp. 45–46. – OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, pp. 201–202, fig. 134.

Description: Head $5\,^1/_2$ in length; depth $7\,^1/_2$; depth of caudal peduncle $12\,^2/_3$; eye 4 in head; snout $3\,^1/_2$; maxillary $2\,^1/_2$; D. 13; A. 17; P. 15.

Body long, slender, considerably compressed; caudal peduncle notably long. Head long, not so deep or broad as body; snout rather blunt, the lower jaw projecting. Eye small, directed laterally; interorbital space convex, distance between eyes equal to length of snout. Mouth oblique; maxillary extending to a point below middle of pupil. Teeth simple, long, slightly cusved backward, in single row on each jaw; no canines. Gill opening broad, extending very far forward; the isthmus narrow. No papille on inner edge of shoulder girdle. Gill-rakers long and slender. No barbels on head.

Head and body naked. Skin along median part of back anterior to dorsal, with peculiar feather-shaped structure; median elevation with short, oblique, lateral branches.

Dorsal extending a little farther posteriorly than anal. Caudal slightly notched, lobes rounded. Anal inserted much in advance of dorsal. Pectoral rounded, without detached rays on upper edge. Ventrals short, free from body posteriorly.

Color in life translucent, in spirits yellowish white; lips with minute brownish dots; occiput with a few small spots of same color; median dorsal area with small dots; a brownish black line on throat and anterior half of belly. Some specimens have the color less intense than have others, the small spots on occiput often being absent.

Type locality: Southern Japan.

Habits: The present species is distributed in the whole Japan except Hokkaidô, and ascends into rivers, in the breeding season. They deposited eggs under the stones in somewhat deep and stagnant waters, abount 5–30 cm..

The eggs are rod-like, measured $0.69–0.77 \times 3.1–3.4$ mm., with many slender filaments at the tip by which the eggs attached to stones.

Distribution: Niigata, Echigo; Hiroshima (JORDAN & SNYDER); Isobemura, Yamada, Mie Prefecture (JORDAN & HUBBS); Wakayama Prefecture (UI); Ise Bay, Aichi Prefecture; Tosa Bay, Kôchi Prefecture; Yura River, Kyôto (MIYADI); Aomori to Kagoshima (JORDAN, TANAKA, SNYDER); Kôchi fish-market, Kôchi Prefecture (KAMOHARA); Aomori; Mie Manazuru, Kyôto; Fukushima; Iwate Prefecture (KOYAMA).

Remarks: In 1904, KITAHARA[1)] published a short paper on the habits and development of *Leucopsarion petersi* HILGENDORF. He described as follows. "It lives in the sea for the greater part of the year and only in a particular season (that is from the end of March to April) enters rather clear streams with gravelly bottom where they spawn. Fishermen scarcely ever catch the fish in the sea, because they are scattered over so wide a space of water. But they offer in some districts an attractive sport to those who

1). KITAHARA, T. 1904, Ann. Zool. Jap., vol. v, part iii, pp. 113–115, pl. v.

standing with his dip-net on the bank of a stream would capture the tiny crystal fish just as they enter the river mouth from the sea in schools. Before entering the river the fish are usually slightly tinged with brown, which however rapidly fades away while the head reddens in freshwater. In both the male and the female there are stellate pigment spots on the operculum and on both sides of the median line on the back. In the female, a special series of somewhat conspicuous spots is present on each side of the median line of the abdomen, along which an inconspicuous cutaneous fold is to be seen. Very conspicuous in the living fish is the globular air-bladder, seen through the flesh and bones in the hind part of the anterior half of the body, but missed by HILGENDORF in preserved specimens."

The male fish is, as a rule, a little smaller than the female; the former being about 45 mm., and the latter, about 50 mm., long. The left ovary, when fully developed, reaches 11 mm. in length and the right 9 mm., each with a semicircular notch on the median side for reception of the globular air-bladder. Nearly 400 ova are found in the two ovaries. The ovum, when ripe, is round, colorless and transparent and about 0.75 mm. in diameter. The vitellus contains no oil globule. The egg-envelope consists of two layers, the outer of which is sticky and is of a reticular structure showing for the most part slit-like meshes. The ovum, when deposited, sticks itself by that outer layer to any foreign solid body; the layer eventually splits and separates off from the inner layer except at the micropyle, and by turning itself inside out, forms a sort of stalk by which the egg is fixed. The process is just like that seen in the egg of *Osmerus*, *Hypomesus*, *Plecoglossus*, *Salanx*, *Gobius*, etc. The egg of *Leucopsarion petersi* then gradually swells up, elongating at the same time, so as to assume a club-like shape.

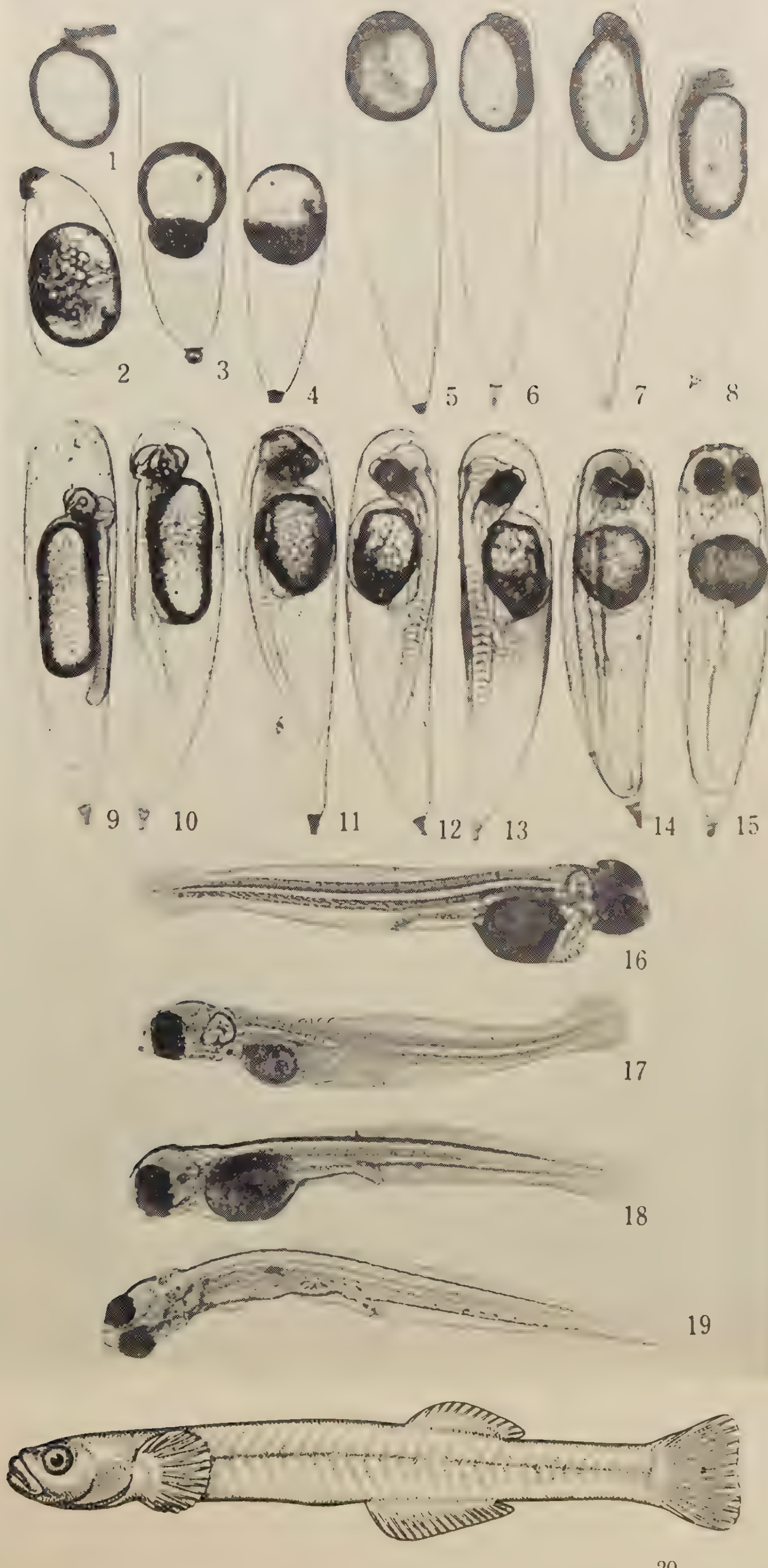
The fish never go up stream to a great distance, but remain within 5 or 6 km. of the river mouth, burrowing under stones somewhat larger than the wrist and which are far more than half their height buried in the sand of the river bottom. In that situation, the females find a safe cradle for depositing eggs. These are attached in patches to the under surface of the stone. One such patch usually consists of about 350 eggs all nearly in the same stage of development, and seems to be a spawn from a single male. The club-shaped egg measures 30–35 mm. in length and 1.0–0.8 mm. in diameter, tapering towards the basal stalk. The vitellus is of a somewhat elongate form; the blastoderm is always found on the side directed towards the stalk, while the head of the embryo develops on the opposite side. The embryo can be made to slide freely from one end to the other but not to turn over within the envelope. Concerning the period of hatching and further history of the young fish I have no observation at present. Nevertheless it may be presumed that after hatching the young fish soon go down stream into the sea, where they remain until the next spring.

KATAOKA, TERUO made the ecological observation on *Leucopsarion petersi* HILGENDORF at Matoya, Isobe Machi, Shimagun, Mie Prefecture and Gokashoura, Shimotsuura, Nansei Machi, Wataraigun, Mie Prefecture, during 1958. In the breeding season of February and March, matured fish (34.5–49.5 mm. in body length) move to shallow

PLATE LIX

Development of ***Leucopsarion petersi*** HILGENODRF, after T. KATAOKA.

1. Unfertilized egg.
2. Fertilized egg.
3. Two cell stage, 2 hours after fertilization under water temperature of 15-21°c.
4. Blastula stage, 16 hours after fertilization.
5. Gastrula stage, 26 hours after fertilization.
6. Early embryo with eye vesicle and few myotomes, 42 hours after fertilization.
7. Advanced embryo with Kupffer's vesicle, 50 hours after fertilization.
8. Embryo with 16 myotomes; otocyst formed, 66 hours after fertilization.
9. Embryo with 20 myotomes, 73 hours after fertilization.
10. Embryo with 31 myotomes, melanophores on eye; body moves slowly 101 hours after fertilization.
11. Embryo with 36 myotomes; 149 hours after fertilization, heart beating, eye with yellowish metalic color.
12. Embryo moves; swim bladder and anus formed.
13. Embryo with 38 myotomes 255 hours after fertilization; melanophores on swim bladder.
14. Embryo elongate with opened mouth and somewhat developed pectoral fin.
15. Well-developed embryo, just before hatching out.
16. Just hatching larva, 4.35 mm. body length.
17. Larva, 3 days after hatching, with developed dorsal fin.
18. Larva, 6 days after hatching, with small absorved yolk sac; many melanophores on swim bladder and eight melanophores formed on the myotomes behind anus.
19. Larva 5.5 mm. in size, 11 days after hatching; yolk sac completely absorved; 13 melanophores on myotomes; alimentary canal and branchial apertures developed. Pectoral fins large.
20. Adult of *Leucopsarion petersi* HILGEDORF.


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water of inner bay and ascending streams along the coast for spawning. The eggs are deposited on somewhat larger stones burried in sands and pebbles, making a mass of 300–500 in number. They attached to stones with a bundle of slender filaments at the base. Unfertilized egg is cubical but after fertilization, egg capsule becomes elongate, somewhat convoluted, measuring 27.5–35.5 mm. × 0.75–0.85 mm. in size.

Table 123. Measurements of *Leucopsarion petersi* HILGENDORF.*

Total length	39mm.	36mm.	36mm.
Depth expressed in hundredths of length	13	13	14
Depth of Caudal peduncle	8	7.5	8.5
Length of Head	21	20	21
Length of Snout	6	5.5	5.5
Width of Interorbital space	4	5	5
Diameter of Orbit	4	5	5
Distance from Snout to soft Dorsal	51	61	60
Height of longest dorsal rays	10	11	6
Distance from Snout to Anal fin	55	55	54
Height of longest Anal rays	12	11	7
Length of Caudal peduncle	21	21	21
Length of Caudal fin	14	15	15
Length of Pectoral fin	14	17	14
Length of Ventral fin	7	6	17
Number of Dorsal rays	13	13	13
Number of Anal rays	17	17	17

*These measurements were made JORDAN and SNYDER for the specimens from Niigata, in Echigo collected by Dr. CH. ISHIKAWA.

Genus Luciogobius GILL, 1859.

Luciogobius GILL. Proc. Ac. Nat. Sci. Phila., 1859, p. 146.
Type ········· **L. guttatus**

Characters; Body elongate, moderately compressed, the skin naked. Head long and low, depressed above, with tumid cheeks; eyes widely separated; mouth rather large, terminal oblique, the chin prominent; teeth pointed, no barbels; vomer and palatine toothless; tongue large, notched; gill openings small nearly vertical and anterior to the bases of the pectorals; not extending forward below, separated by a broad isthmus; branchiostegals four on each side. Spinous dorsal wanting. Soft dorsal rather short, opposite the short anal; caudal short, rounded, remote from dorsal and anal; pectorals rather large, rounded, without silk-like rays; ventrals small, the rays indistinct, the two fins united in a rounded in a rounded disk; Interspinal membrane low. Lateral line obsolete.

119. Luciogobius guttatus guttatus GILL.

"Mimizu-haze"

(PL. LX, figs, 1–12)

Luciogobius guttatus GILL, 1859, Proc. Ac. Nat. Sci. Phila., p. 146. – GÜNTHER, 1861, Cat. Fish., III, p. 152. – STEINDACHNER, 1879, Ichth. Beitr. viii, p. 26. – JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., vol. xxiv, no. 1244, pp. 123–124, fig. 29. – UI, 1932, Kisyugyofu, p. 248. – OKADA et IKEDA, 1938, Sci. Rep. Tokyo Bun. Daigaku, Sect. B, no. 55, pp. 152–153. – OKADA et IKEDA, 1938, Sait. Hôonkai Mus., Resear. Bull., no. 15, p. 115, pl. vii, fig. 2. – AOYAGI, 1958, Gen. Notes Freshwat. Fish. Jap. Arch., pp. 218–219, fig. 182.

Luciogobius elongatus REGAN, 1905, p. 23.

Luciogobius guttatus guttatus TOMIYAMA, 1936, Jap. Journ. Zool., vol. vii, no 1, pp. 51–52, fig. 10.

The original description* is as follows:

7. **L. guttatus** GILL.*.– The body is much elongated and imperceptibly declines to the caudal fin. The height at the pectorals is between a twelfth and thirteenth of the extreme length, and near the caudal, it is rather more than a seventeenth of the same length.

The head is oblong oval above; it forms about two-nineths of the total length; its breadth equals five-nineths of the length, and is twice as great as the height.

The dosal is situated slightly anterioly to the sixth-tenth of the extreme length; it is oblong and sustaind by two inarticulate and twelve branched rays. The anal is under the dorsal, and has thirteen rays, the first of which is small and inarticulate.

The body is brown, thickly punctured with black; the caudal, dorsal and pectoral fins are also dotted with black.

A single specimen of the length of two inches and a half is in the collection.

Description; Head 4.5 in length; depth 6.5; depth of caudal peduncle 9.5; eye 8.5 in head; snout 4.5; D. 13; A. 12; P. 17.

Body cylindrical anteriorly; caudal peduncle not much compressed. Head broad and depressed; the cheek muscles greatly developed, bulging outward and upward, making a deep concavity on top of head. Eyes small, directed obliquely upward; interorbital space concave, the eyes projecting somewhat above its floor. Snout rather pointed, its length contained about 3 times in postorbital part of head; lower jaw projecting. Mouth almost horizontal; the cleft wide, extending to a vertical passing just behind orbit. Teeth minute, in narrow bands on both jaws; no canines. Tongue broad at tip. Gill openings narrow, extending upward but little above middle of base of pectoral; the isthmus very broads its width about equal to depth of caudal peduncle. Inner edge of shoulder girdle without protuberances. Gill-rakers on first arch represented by slight elevations only.

Head and body naked; skin of snout wrinkled; lips pendulous; anterior nostril with a short tube. No barbels.

Spinous dorsal absent. The skin in the region which is occupied by the fin in other

*GILL, 1859, Proc Acad. Nat. Sci. Phil., p.146.

Gobies has a peculiar folded structure, shaped somewhat like a feather, a median elevated ridge, with small radiating ridges on either side; the latter extending posteriorly along the base of soft dorsal. Soft dorsal inserted directly above first ray of anal; the distance between tip of snout and insertion of dorsal about equal to 3 times length of head; depressed fin falling far short of caudal; anal lower than dorsal; the height of rays about 2 times the diameter of eye; membranes of both dorsal and anal fleshy. Caudal rounded posteriorly. Pectoral rounded, the upper edge without filamentous rays. Ventral disk small, broad, free posteriorly.

Color in spirits light yellowish olive; upper parts darkened by a close stipping of blue-black, the points growing larger and farther apart on the ventral surface; dorsal parts and sides of head and body with small, round spots of the light body color.

Dorsal fin with about 4 longitudinal rows of indistinct, small dark spots on the rays. Caudal with vertical, wavy, dark bands, broader than the light interspaces. Anal white, except a very narrow dusky area at base. Pectoral dusky. Ventrals without dark color. (JORDAN & SNYDER).

Type locality: Japan.

Distribution: Cave of Daikon-zima, Shimane Prefecture; Artesian well, Gobo, Hidaka-gun, Wakayama Prefecture; Misaki-mura, Hattagun, Kochi Prefecture; Uwazima, Ehimane Prefecture (TOMIYAMA); Southern part of Hokkaidô; Japan proper; Yakushima (OKADA & IKEDA); Nishidagawa-gun, Yamagata Prefecture (OKADA & IKEDA); Otaru, Hokkadô (NOZAWA & TOMIYAMA); Ryûkyû (AOYAGI); Korea (TOMIYAMA); Mano, Ryozu, Sado (OSHIMA).

Remarks: TOMIYAMA[1)] remarked many variations of outer configurations in shore specimens by figures. He also described the albinos from the cave of Daikon-zima which have fewer dorsal and anal rays, larger head, degenerated eyes and no free pectoral rays. The specimens from the artesian well show the elongate body, fewer dorsal and anal rays, the eyes covered by skin, and no free pectoral rays.

According to the study of the life history of *Luciogobius guttatus* GILL, made by DOTU, YOSHIE[2)], during 1947 in various localities of Honshû, Shikoku and Kyûshû, the present species exhibits distinct individual variations in the outer feature, coloration, and number of fin-rays as well as vertebrae. Around Fukuoka City, Kyûshû, the spawning season occurs during January and May. The number of ovarian eggs of a female are enumerated from 360 to 1,671. The breeding room is constructed as flat burrow under the stone wher the parent fish find. The female deposits eggs on the under side of stone, hanging down from the stone in one layer mass. The number of the eggs of one sheet are enumerated 784 and 960 in two cases. After spawning, the female leaves the nest, while the male guards the eggs until they hatch.

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1). TOMIYAMA, 1936, Japan. Journ. Zool., vol. vii, no. 1, p. 52.
2). DOTU, YOSHIE, 1957: Scie. Bull. Facu. Agric. Kyûshû Univ., vol. 16, no. 1, pp. 93–100, figs. 1–6, tables. 1–2. (in Japanese).

Eggs are club-shaped, measuring 2.5 mm. × 0.7 mm. in size, with weak indentation around the top of egg capsule and a small bundle of filaments attaching to substratum at the base. The incubation period lasts about 10 days under the water temperature 15–20°c.

Newly hatched larva is 3.5 mm. in long. The larva 7–22 mm. in size, are found swimming in the middle of water near shore, feeding on pelagic copepods. Advanced larvae attained over 15 mm. in size, they move into shallow water to make bottom life.

Subfamily Sicydiaphinae

Characters: Body elongate, with scales or not; branchial aperture not broad. Dorsal lst and 2nd; the second one not extended. Left and right ventrals united, attached to belly partially or wholly by base. Labial teeth unfrequently present on lower jaw. Tooth of lower jaw simple, in one line; that of upper jaw in one line. Head long; with scales on head and cheek.

Genus Sicydium Cuvier et Valenciennes, 1829.

Type……… **Gobius plumieri** Bloch

Characters: Body subcylindrical, covered with ctenoid scales of rather small size; head oblong, with the cleft of the mouth nealy horizontal and with the uppe jaw prominent; lips very thick; the lower lip generally with a series of minute teeth. A series of numerous small teeeth in the upper jaw, implanted in the gum and moveable; the lower jaw with a series of conical widely-set teeth. Eyes of moderate size. Two dorsal fins, the anterior with six flexible spines; caudal quite free; ventral fins united to a short semicircular disk, more or less adherent to the belly. Gill-openings of moderate width; branchiostegals four; air-bladder none. Pseudobranchiae, a slit behind the 4th gill.

120. Sicydium japonicum Tanaka.
"Bôzuhaze"
(Text-figs. 118)

Sicydium japonicum Tanaka. 1909, Journ. Coll. Sci. Imp. Univ. Tôkyô, vol. xxvii, Art. 8, pp. 22–25. Jordan, Tanaka et Snyder, 1913, Cat. Fish. Jap., p. 358. – Ui, 1932, Kisyu Gyofu, pp. 243–244. – Tomiyama, 1936, Jap. Journ. Zool., vol. vii, no. 1, p. 99. – Okada et Ikeda, 1938, Trans. Biog. Soc. Jap., vol. 3, no. 1, pp. 83–84, pl. iv, fig. 2. –Okada et Nakamura, 1948, Nihon Tansuigyorui, p. 208, fig. 144. – Aoyagi, 1958, Gen. Notes Freshwater Fish. Jap. Arch., pp. 246–248, fig. 199.

Sicyopterus japonicus, Tanaka, Figur. Descrip. Fish Jap., pp. 203–206, pl. lvi, figs. 209, 210, 211; pl. lviii, fig. 215.

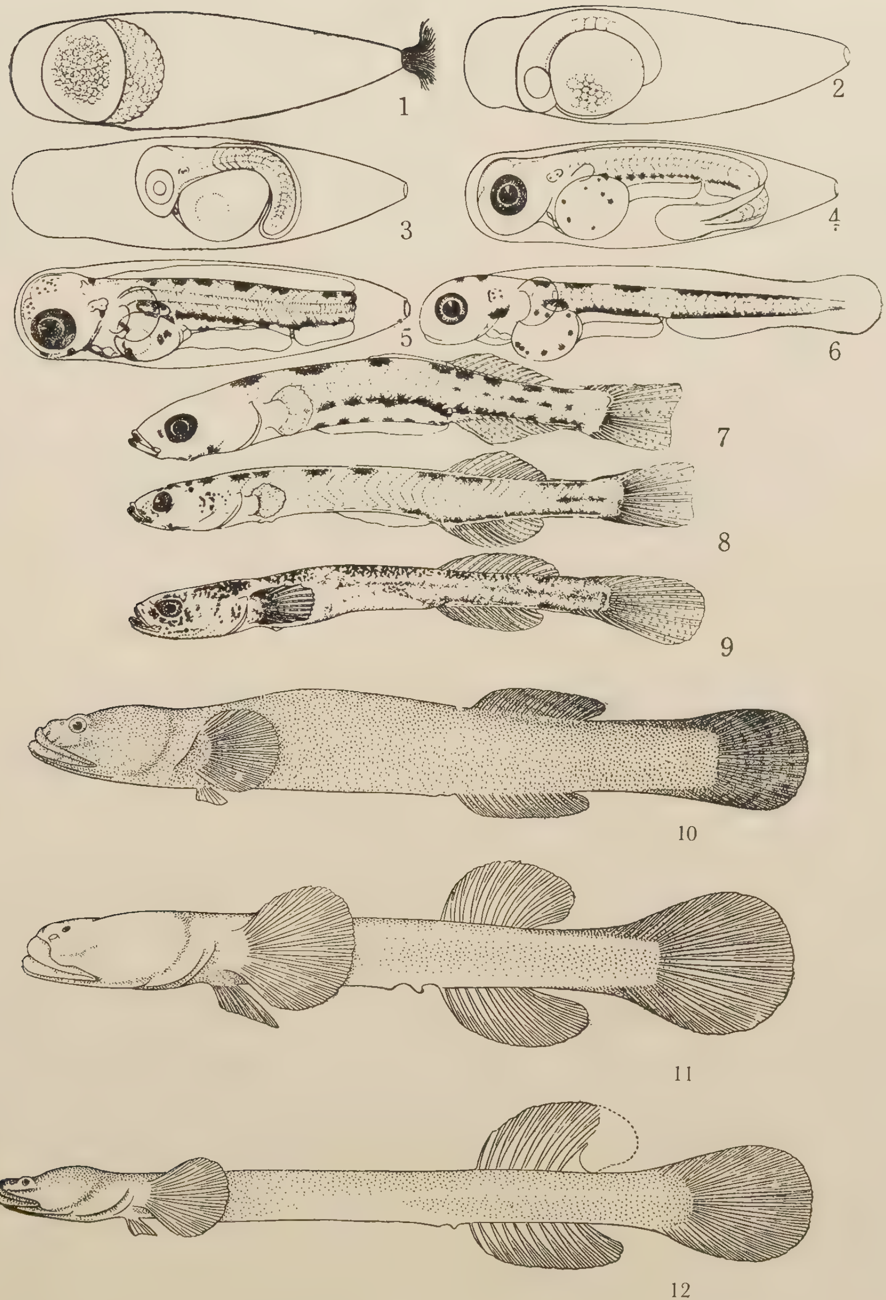
PLATE LX

Development of ***Luciogobius guttatus guttatus*** GILL, after Y. DOTU (1957).

1. Morula stage, with bundles of adhesive filaments at the base of egg-capsule.
2. Early embryo with 3 myotomes and Kupffer's vesicle.
3. Embryo with 17 myotomes, forming optic lens and otocyst.
4. Embryo 7 days after spawing.
5. Embryo 10 days after spawing, just before hatching.
6. Newly hatched larva, 3. 5 mm. in total length.
7. Post-larva, 8. 5 mm in total length.
8. Post-larva, 14. 2 mm. in to llength.
9. Juvenile, 18.0 mm. in total length.

10-12. Variations of adult, after I. TOMIYAMA.

PLATE LX

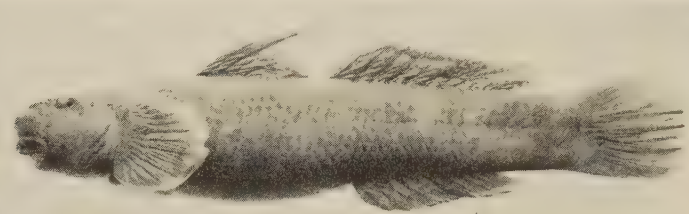


The original description* is as follows:

Sicydium japonicum n. sp.

Head 4 ½–4 ¾, height of body about 4½ in total length as measured to root of middle caudal rays. Eye 6–5, interorbital 2 ½–2, snout 2 ½–2, height of caudal peduncle 1 ⅔–1 ½, pectoral 1 ⅕, ventral 2–1 ½ in head.

Body subcylindrical, only slightly compressed; caudal peduncle high, very much compressed. Head rather small, broad, slightly depressed. Eye small, in middle of length of head; its upper margin on dorsal profile. Interorbital broad, being 2 ⅓ times diameter of eye in breadth, slightly concave. Snout rather abrupt in profile, its tip pointed when viewed from side, broadly rounded when viewed from above. Mouth horizontal, beneath overhanging snout; lips wide, fleshy. Maxillary completely con-



Text-fig. 118. ***Sicydium japonicum*** TANAKA.

cealed beneath preorbital and lips, extending to vertical passing through posterior edge of pupil. Teeth in upper jaw movable, very small, acute, close-set, in one row; behind this another row of large teeth more or less concealed in gum; teeth in lower jaw much larger, canine-like. very few in number, in one row; no teeth on vomer and palatines. Tongue rounded, free anteriorly, Gill-openings lateral, slightly oblique, directly in front of base of pectoral, the width being scarcely greater than length of the latter; gill-membranes united to throat, free from isthmus; the distance between both gill-openings slightly greater than interorbital width; gill-arch almost smooth, so that gill rakers on it are not perceptible. First dorsal inserted above posterior half of pectoral and nearer to origin of second dorsal tnhan to tip of snout; third spine filiform, either reaching beyond or not reaching origin of secone dorsal; web between last two spines broader than preceding ones; the fin united to back behind last spine by a membrane. Second dorsal above vent; distance between origin of the fin and base of last spine of first dorsal equal to length of snout; the rays subequal in height except first ray, about 1 ⅔ in head; the fin without a membrane behind last ray. Anal inserted below third ray of second dorsal, similar in form to second dorsal, not adnate to body behind last ray; both fins extending posteriorly to same vertical some distance before base of caudal. Pectoral rather short, posteriorly rounded, extending midway between origin of ventral and vent; without silky rays above. Ventral adnate to body, small, its disc almost circular, extending beyond anterior half of pectoral. Caudal raounded.

Scales small, strongly ctenoid; those on anterior parts of body and on base of caudal much smaller, cycloid; nape closely covered with small cycloid scales. Head, breast and belly naked. No lateral line.

Colour in formalin gray, pale beneath; about 11 cross bands of brown colour, some of the bands forked above or even entirely split into two; colour of the bands gradually fading out beneath middle of side of body; the first band across nape, the second immediately in front of dorsal, the third to fifth below first dorsal, the sixth to ninth below second dorsal, the tenth on caudal peduncle and the

*TANAKA, SH., 1909, Journ. Coll. Sci. Imp. Univ. Tokyô, vol. 28, Art. 8, pp. 22–25.

last on base of caudal. In the middle of caudal a more or less distinct spot. Interorbital band very indistinct, extending from below eye to angle of mouth. First dorsal brownish, with a few rows of indistinct spots; second dorsal as well as anal much darker, the former with several wavy rows of brown spots and with very narrow blackish edge; anal with or quite without several indistinct rows of spots, near its edge a blackish line somewhat wider than that of second dorsal, edge itself whitish. Both pectoral and ventral dusky, without distinct markings (in one specimen anterior edge of ventral brown). Caudal dusky, with several raws of indistinct spots on proximal parts.

The species seems to be very closely allied to *Sicydium halei* DAY from Ceylon known to me only from its original description, but differs from it in having stouter body, longer caudal, and smaller eye.

The type, 7.7 cm. long as measured to root of middle caudal rays, was obtained by Mr. ODA in Tosa (Shikoku); its register number in the University collection is 2138. An other specimen, 9 cm. long measured in the same way as above, was collected by Mr. NAKAJIMA, in the prefecture of Wakayama. That specimen differs from the type in the following points: mouth extending to anterior edge of pupil; first dorsal much more filiform, exending to second ray of second dorsal; caudal whitish at posterior angles.

Description: Head. 3.7–4.1 in body length exclusive of caudal; depth; 5–6.1. Type 4.8-5.7 in head; snout 2.1–2.3; interorbital space 2.3–2.8; depth of caudal peduncle 1.9–2.1; maxillary 2.1. D. VI. 1, 10+1; A. 11+1. Scales in longitudinal series 58–61, in transverse 15–16. Body subcylindrical; caudal peduncle broad, extremely compressed. Head rather small, broad slightly depressed, entirely naked. Eye small, in middle of length of head; interorbital space broad, slightly concave; snout rather rouded, its tip pointed when viewed from side. Mouth horizontal, upper lip projecting than lower lip; maxillary completely concealed beneath preorbital and lips, extending to vertical passing through anterior rim of eye; lower jaw included. No lateral line.

First dorsal inserted above posterior half of pectoral and nearer to origin of second dorsal than to tip of snout; third spine filiform, reaching beyond origin of second dorsal. Second dorsal above vent; distance between its origin and base of last spine of first dorsal equal to length of snout. Anal inserted below third ray of second dorsal, not adnate to body behind last ray. Pectoral rather short, posteriorly rounded, extending midway between origin of ventral and that of anal; ventrals united, small, the disk circular, extending beyond anterior half of pectoral; caudal rounded. Scales small, ctenoid; those on anterior parts of body and on base of caudal much smaller, cycloid.

Color in formalin dark gray; pale beneath; about 10 cross bands of brown color, some forked above or even entirely spit into two; the first band across nape, the second immediately in front of first dorsal; the first band across nape, the second immediately in front of first dorsal, the third to fifth below the fin, the sixth to eighth below second dorsal, the ninth and tenth on caudal peduncle; somewhat distinct spot at the base of the middle caudal rays. Interobital band very indistinct, continued below eye to angle of mouth; a narrow, short one behind this band. First dorsal brownish, with a few rows of indistinct spots; second dorsal as well as anal much darker, the former with several wavy of brown spots and with very narrow black edge; anal with several rows of brown spot, near its edge a black line somewhat broader that of second dorsal, edge itself whitish. Both pectoral and ventral dusky, without distinct markings; anterior

edge of the ventral fin brown; caudal dusky, with several rows of indistinct spots on proximal parts.

Type locality: Kôchi Prefecture; Wakayama.

Habits: The present species is dwelling on tne bottom of clear stream. The food is mostly aquatic insect and micro-algae. The spawning habits are not yet mentioned.

Distribution: Kôchi Prefecture; Wakayama (TANAKA); Yaita, Tochigi Prefecture south to Kawanabe, Kagoshima Prefecture; Amami-Ôshima; (TOMIYAMA); River Tsubo, A branch of Nagara River, Gifu Prefecture (OKADA); Wakayama Prefecture (UI); Tosa, Kôchi Prefecture; Kii; River Kinokawa, Wakayama Prefecture; Miyazaki, Hyuga (JORDAN, TANAKA, SNYDER); River Hôki, River Naka, Tôkyô (TANAKA & AOYAGI); River Omoi, River Tone, Ibaraki Prefecture (AOYAGI); Kasumigaura (TAKATSUKA); River Esumi, Chiba Prefecture (AOYAGI); River Fuji, Yamanashi Prefecture (TANAKA); River Tomita, Wakayama Prefecture (JORDAN & HUBBS); River Hidaka, Wakayama Prefecture (UI); Susaki, Agei, Kôchi Prefecture (KAMOHARA); Uwajima, Ehime Prefecture (JORDAN & HUBBS); Manse River, Ta River Ise, River Kimotsuke, Kagoshima Prefecture (OGAWA); Amamiôshima (JORDAN, TANAKA, OKADA); River Midori, Kumamoto Prefecture (KOBA).

Remarks: TOMIYAMA* noted that his specimens have a pair of canines behind the symphysis of lower jaw and exhibit much variation in every character.

Family Cottidae

Characters: Body moderately elongate, fusiform or compressed, tapering backward from the head, which is usually broad and depressed. Eyes placed high, the interocular space usually narrow; a bony stay connecting the suborbital with the preopercle, usually covered by the skin; upper angle of preopercle usually with 1 or more spinous processes, the head sometimes wholly unarmed. Teeth equal, in villiform or cardiform bands on jaws, and often on vomer and palatines; premaxillaries protractile; maxillary without supplemental bone. Gills $3^1/_2$ or 4, slit behind the last small, often obsolete; gill membrane broadly connected, often jointed to the isthmus. Body naked, or variously armed witu scales, prickles, or bony plates, but never uniformly scaled; lateral line present, simple. sometimes chain-like. Dorsal fins separate or somewhat connected, the spines, 6 to 18 in number, usually slender, sometimes concealed in the skin, the soft part elongate; caudal fin separate, usually rounded, rarely forked; anal fin similar to the soft dorsal, without spines; pectoral fins large, with broad procurrent bases, the rays mostly simple, the uppe sometimes branched; ventrals thoracic, rarely entirely wanting, the rays usually 1, 3 to 1, 5, their insertion well forward. Pseudobranchiae present. Vertebrae numerous, 30 to 50. Scapular arch normal; myodome developed; actinods large, partly intervening between coracoids; ribs sessile on the vertebrae. Pyloric caeca usually in small number (4 to 8); air bladder commonly wanting.

Subfamily Cottinae

Characters: Body cylindrical. Head armed with weak prickles and skin smooth. Teeth villiform, on both jaws and vomer, sometimes on palatine. Gill rays 6.

Key to Japanese genera of Cottinae

a[1] Distinct ridge line on suborbital and on dorsal side of head. Small spinous processes on skin. Spines on preopercle strong, hook like. .... **Trachidermus**
a[2] Without ridge line. Dorsal side of head rounded. .... **Cottus**

Genus Cottus (ARTEDI), 1738.

Cottus ARTEDI, 1738, Genera Piscuim, p. 49.
Cottus LINNAEUS, 1758, Syst. Nat. ed. 10, I, p. 264.

Type .... **Cottus gobio** LINNAEUS

Characters: Body fusiform. Head large, broad, and more or less depressed, feebly armed; skin smooth or more or less velvety, its prickles, if present, not bony or scale-like; villiform teeth on jaws and vomer, and sometimes on palatines. Isthmus wide, the gill membrances not forming a fold across it. Mouth large, the upper jaw protractile. A bony stay across the chee. Branchiostegals 6; suborbital stay fiat, without a ridge, no ridges on operle. Dorsals rounded, contiguous, the first of 6 to 9 slender spines; ventrals moderate, with 4 soft rays and concealed spine; pectoral ray usually all spines, lower ones always so. Lateral line present usually more or less chain-like, sometimes incomplete. Preopercle with a simple, spine at the angle which is usually curved, upward, its base more or less covered by skin, very rarely obsolet; usually 2 or 3 spines turned downward. Vertebrae $10+23=33$; phloric caeca about 4.

Key to the Japanese species of Cottus

a[1] Number of spines on the preopercle 4; teeth on palatine. Dorsal fin 8 spines, 14–15 rays; .... **C. kazika**
a[2] Number of spines on the preopercle 3, somewhat indistinct; no tooth on palatine. Dorsal fin 8–9 spines, 17–19 rays. Anal fin soft rays. Distinct yellow-brown striations along the lst dorsal fin margin. .... **C. pollux**
a[3] Number of spines on the preopercle 1, no tooth on palatine.
b[1] No tooth on palatine; dorsal fin 9 spines.
c[1] Body long, 1 distinct spine on the preopercle; Dorsal fin 15–18 rays; without tubercles on the skin of arm pit. .... **C. japonicus**
c[2] Body big and short. An invagination on the lower margin of a spine on the preopercle; many pointed tubercles on the skin of arm pit; dorsal fin 17–20 soft rays. .... **C. reinii**
b[2] Dorsal fin 8 spines and 21 rays. Anal fin 16 rays; pectoral fin 14 rays. ...... **C. hangiongensis**

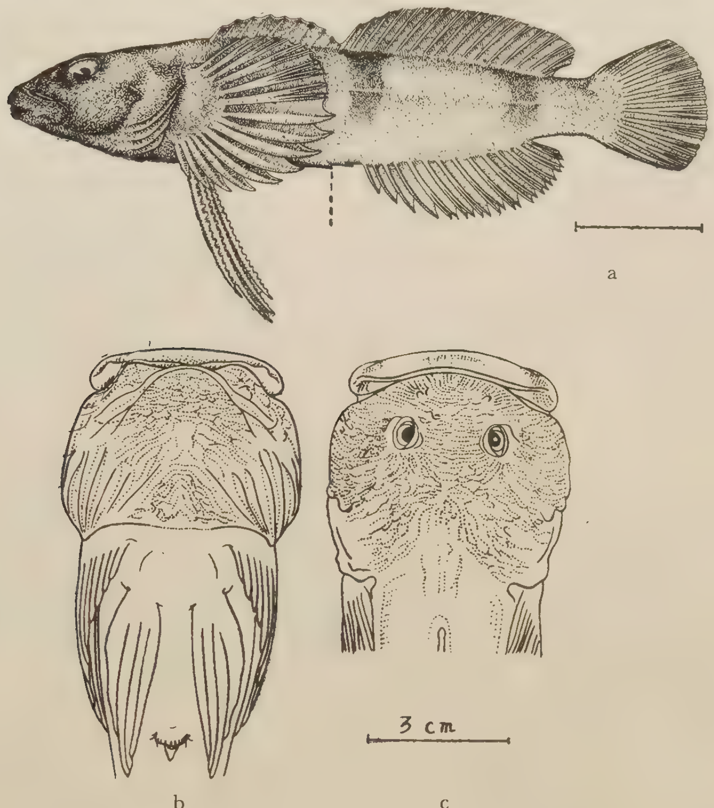
121. Cottus pollux GUNTHER.

"Hanakazika"

(PL. LXI, figs. 1–17; Text-figs. 119. a–c)

Cottus pollux GÜNTHER, 1873, Ann. Mag. Nat. Hist., p. 240.

Cottus nozawae SNYDER, 1911, Proc. U. S. Nat. Mus., vol. 40, no. 1836, pp. 536-538. - OKADA et IKEDA, 1938, Sci. Rep. Tôkyô Bunrika Daigaku, sect. B, no. 55, pp. 151–152, text fig. 6. - AOYAGI, 1958, Gen. Notes Freshwater Fish. Jap. Arch., pp. 207-208, fig. 173.



Text-figs. 119. a. ***Cottus pollux*** GUNTHER, after M. WATANABE.
b. ***Cottus pollux*** GUNTHER, (dorsal side), after M. WATANABE.
c. ***Cottus pollux*** GUNTHER, (ventral side), after M. WATANABE.

The original description* is as follows:

Cottus nozawae is distinguished from other Japanese species of the genus by the following combination of characters: Three preopercular spines, naked palatine, four ventral rays, and a very short maxillary which reaches to anteriors border of eye and not beyond anterior border of pupil.

*SNYDER, 1911, Proceeding U. S. Nat. Mus., vol. 40, no. 1836, pp. 536–538.

Head 3.2 in length to base of caudal; depth 4.5; depth caudal peduncle 3.2 in head; snout 3.2; eye 3.6; interorbital space 7; maxillary 2.7; D. VIII, 17; A. 13; p. 15; pores in lateral line about 30.

Body moderately robust, the head short, snout blunt; interorbital area and occiput convex; maxillary not quite reaching pupil; anterior nostril with a low tube, the posterior one with a scarcely evident rim; preopercle with a long slender, curved spine at its appendage; two smaller spines below this pointing downward and forward; a sharp spine on lower edge of opercle; nasal spines not evident, palatines naked; vomer with a small area beneath pectoral; other parts of body naked and smooth. Dorsals entirely separate, the membrane of spinous dorsal just reaching base of first ray; middle spines highest, 3 in head; longest rays about 2.3. Anal rays about 2.8; both dorsal and anal falling far short of caudal when depressed. Ventral rays 1, 4, not reaching vent. Pectorals reaching a ventral through base of first anal ray.

Color light below, clouded with dusky above; four more or less definite saddle like spots on back; two below spinous dorsal band two below soft dorsal; a narrow, dark band on base of caudal; rays and spines of fins with rows of dark spots.

Type: - Cat. No. 68237, U. S. N M., a specimen 85 mm. long, from the Ishikari at Sapporo. Cotype, No. 21425, Stanford University collection.

Named for Prof. SUNZIRO NOZAWA.

Description: Total length 161.9 mm. to 92.4 mm.; length exclusive of caudal fin 139.4 mm. to 78.2 mm. Depth 4.7 to 3.8 in length, at the origin of dorsal fin; head 3.2 to 2.6. Eye 5.8 to 4.4 in head; snout 3.3 to 2.7; interorbital space 7.1 to 5.3; depth of caudal peduncle 4.2 to 3.3. D. IX to VIII, 19 to 17, all rays except first one or three rays branched, but in the young specimens such a branching indistinct; A. 15 to 13, last eight or four rays braanched, but in the young specimens such a branching indistinct; P. 15 to 14, above five or six rays except first one branched, length of pectoral 5 to 3.1 in length; V. I, 4. Lateral pores 39 to 34. Preopercle with three spines. Fine

Table 124. Measurements of *Cottus pollux* GUNTHER (*Cottus nozawae* SNYDER)* after M. WATANABE.

	Number of specimen	maximum value	minimum value	mean value
Total length	147	20.5	7.0	11.0
Body length	147	17.5	5.7	8.1
Number of Dorsal fin ray	147	IX-20	VII-16	IX-19
Number of Anal fin ray	147	16	16	14
Number of Pectoral fin ray	147	16	12	15
Number of Ventral fin ray	147	I-4	I-4	I-4
Scales on Lateral line	43	45	36	14
Number of Gill raker	139	8	4	7
Number of Vertebrae	5	36	34	35
Number of Pyloric coeca	4	4	3	4
Body length/Head length	45	3.4	2.5	3.1
Body length/Body height	45	6.4	3.7	4.8
Head length/Snout length	45	3.7	2.8	3.2
Head length/Head breadth	45	1.8	1.5	1.5
Head length/Body breadth	45	1.9	1.5	1.5
Head length/Eye diameter	45	6.4	5.4	5.4
Head length/Interorbital space	45	14.4	9.2	9.2
Head length/Caudal length	45	5.3	3.1	4.0
Head length/Caudal height	45	5.5	3.1	4.3
Head length/Pectoral fin length	45	2.5	0.9	1.4
Head length/Ventral fin length	45	2.0	1.0	1.5
Head length/Caudal fin length	45	2.0	1.3	1.7

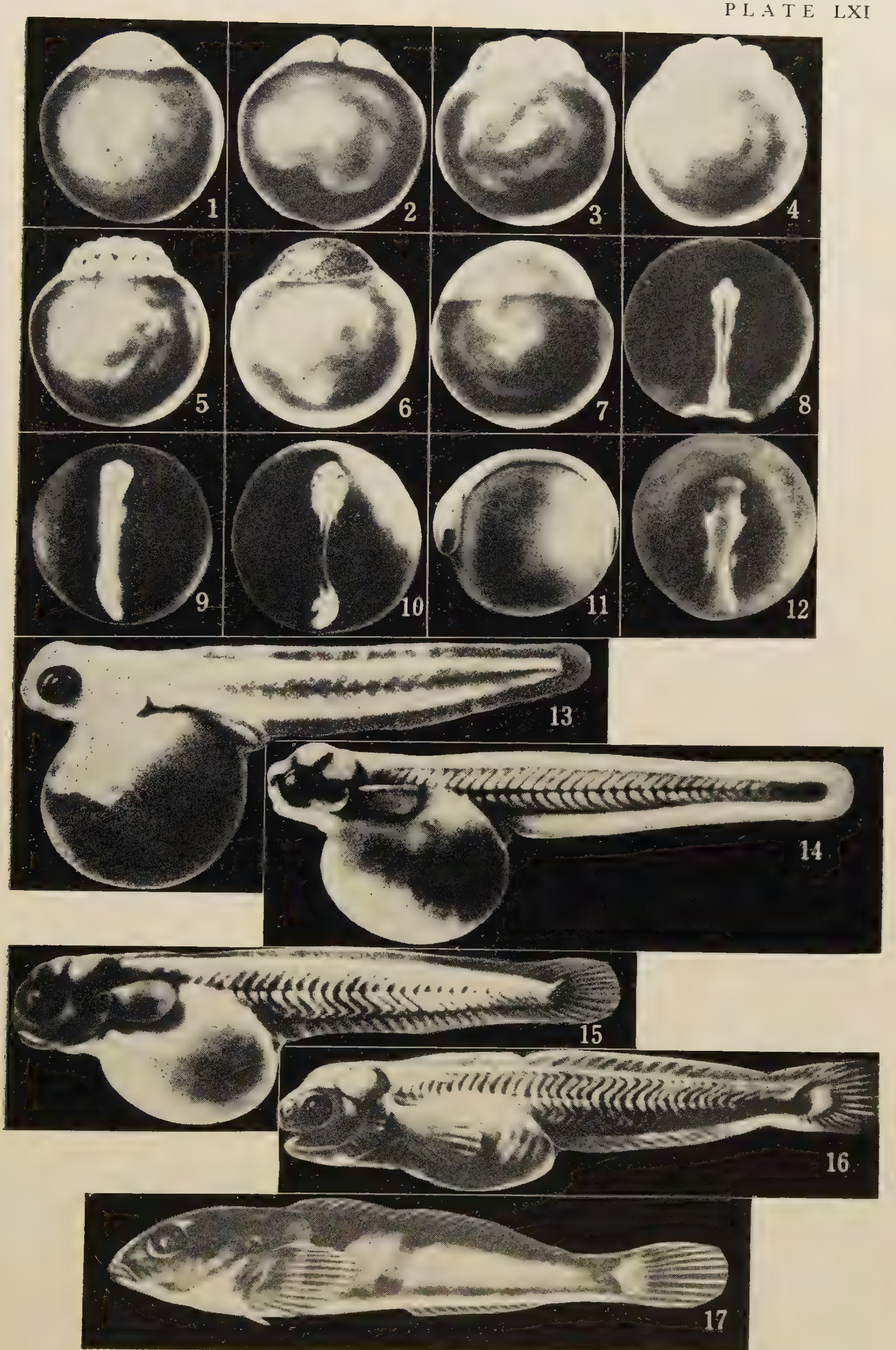
*These specimens are measured by M. WATANABE.



PLATE LXI

Development of ***Cottus pollux*** GUNTHER, after M. WATANABE.

1. Fertilized egg.
2. 2 cell stage.
3. 4 cell stage.
4. 8 cell stage.
5. 16 cell stage.
6. Morula stage.
7. Gastrula stage.
8. Embryo formation.
9. Optic cup formation.
10. Optic lobe formation.
11. Chromatophores appear.
12. Embryo with Kupffer's vesicle.
13. Larva just after hatched.
14. Larva with pectoral fin.
15. Larva with developing myomeres.
16. Larva with large pectoral fin and small yolk sac.
17. Juvenile with simple black stripe on trunk.


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prickles are arranged on the pectoral and ventral rays, and minute prickles cover a small area beneath pectoral.

Color and pattern in formalin generally grayish brown, belly paller, with four irregular saddle-liked gray blotches on back. All the fins with the transverse gray streaks; first dorsal marginally with a five yellowish brown streak.

Ventral in the male relatively longer.

The male is larger than the female. The fin rays of the male ventral fin are longer than those of the female. In the male, the conical process exists just behind the anus.

Type locality: Ishikari River, Sapporo, Hokkaidô.

Distribution: River Ishikari, Sapporo, Hokkaidô (SNYDER); Lake Kucharo; Lake Akan; Lake Shikotsu; Lake Panke; River Chitose; Shikaribetsu; Sôunkei, Hokkaidô (OKADA & IKEDA); River Chitose, Chitose-gun, Hokkaidô; River Oboro, Akkeshi-gun, Hokkaidô; Onnenuma, Nemuro-gun, Hokkaidô; River Kushiro, Kawakami-gun, Hokkaidô (WATANABE); Lake Kucharo, Lake Akan, Lake Shikotsu, River Chitose, River Akan, River Monbetsu, River Ishikari, Hokkaidô (OKADA & AOYAGI).

Remarks: M. WATANABE made embryological observation on the development of *Cottus pollux* GUNTHER collected at River Chitose, and River Naibetsu, Chitose-gun, Hokkaidô and River Oboro, Akkeshi-gun, Hokkaidô during 1948–1950. He has obtained 328 eggs in natural and kept them in Chitose and Oboro Hatcheries to continue his experiment. The egg is measured 2.0–2.3 mm. in diameter. After the artificial fertilization, he made the observation of eggs under the water temperature of 9°C keeping in Chitose Hatchery. The results were as follows.

Time after fertilization	*Stage*	*Water temperature*
36'	2 cell stage	9°C constant
42'	4 cell stage	〃
6 days	Morula stage	〃
14 days	Optic vesicle formation	〃
15–16 days	Hatching out	〃

The embryo of 2.4mm. long formed eye with melanophore and has 5–7 myomeres. The anlage of fins formed. The embryo of 4.5mm. long is provided with melanophores on lateral side. The embryo of 5.0mm. long with 20 myomeres and begins to move in egg. The larva just after hatched 7.5mm. long has still provided with yolk sac.

In general, male is less in number than female, the ratio being 100 : 17.3 in female and male. The male is longer than the female and has a conical short process just behind of the anus. Around Tôkyô, the breeding season occurs in the middle of April. The number of eggs is about 300–400 in the individual measured 70–80 mm. in size. The spawning ground is found in the stony bottom of the middle river of a slow current. Before the season, the both sexes gradually migrate into the spawning ground from the ordinary places. The eggs are deposited under stones, forming a mass which

is composed of about 2,000–3,000 eggs. Eggs are nearly cubical, with the diameter of 3.5 mm. and yellow or reddish orange. They hatch out in 28 days after fertilization under the water tempeature of 8° ± 0.5°C. The fish are generally distributed in the upper water of the middle river and move into the lower river when the water temperature goes down in the end of autumn. They like to gather in the clear, somewhat heavy current water of the pebbly bottom. The food is consisting of aquatic insects as *Ephemera*.

122. Cottus kazika JORDAN et STARKS.

River Sculpin, "Kamakiri"

(Text-figs. 120, a–d)

Cottus kazika JORDAN et STARKS, 1904, Proc. U. S. Nat. Mus., vol. XXVII, no. 1358, pp. 265–266, fig. 15. – UI, 1932, Kisyu Gyofu, pp. 231–232. – MIYADI, 1935, Kyotofu Tansuigyo, p. 42. pl. 5, fig. 41. – OKADA et NAKAMURA, 1948, Nihon Tansuigyo, pp, 198–199, fig. 130. – WATANABE, 1958, Stud. Cottid Fish. Japan, pl. 29, upper; pl. 80, figs. A–I; text-figs. 146–147. – AOYAGI, 1958, Gen. Notes Freshwat. Fish. Jap. Arch., pp. 208–209, fig. 174.

Rheopreste fujiyamae JORDAN et STARKS, 1904, p. 270, fig. 16. – TANAKA, 1911 p. 112, pl. 28, figs. 110–111.

The original description* is as follows:

Cottus kazika JORDAN et STARKS

Head 2 ⅔ in length without caudal; depth 4 ¾. Dorsal VIII–14 to 16; anal 13 to 15; ventral I, 4. Pores of lateral line 28; eye 4 ⅔ in head; interorbital (bone only) 8; maxillary 2 ⅕; snout 4; height of caudal peduncle 4 ½ to 5.

Body deepest at shoulders; head somewhat depressed, the snout narrow; a notch in profile at front of eyes. Mouth rather large; the maxillary reaching to below posterior margin of pupil; lower jaw included or even with upper. Teeth in broad bands on jaws, vomer, and palatines; those on palatines in bands as wide as on vomer and equally conspicuous, somewhat coarser than those on jaws. Interorbital space concave and continuous behind with a broad shallow concave area on top of head, which is between low inconspicuous rounded parietal ridges. Nasal spine sharp; between them are the slightly produced processes from the premaxillaries. Edge of preopercle armed with 4 spines, all sharp, the upper one very strongly hooked upward, the next much smaller, pointing backward, the next hooked downward, and the lowest pointing forward. A small sharp spine on lower anterior end of subopercle directed forward.

Fin formulae of 7 specimens: 5 specimens have 15 dorsal rays; 1 has 16; 1 has 14; 3 specimens have 14 anal rays; 2 have 13; 2 have 15. Longest dorsal spine 5 in head; longest soft ray 3; tips of last dorsal rays not nearly reaching base of caudal. Pectoral reaching a little past front of anal; it has 17 rays, the fifth to the eight from the top the longest, 1 ⅖ in head. The distal fourth or fifth of ventrals extends over the median point between their base and origin of anal. Origin of anal midway between tip of snout and distal sixth of caudal. Caudal truncated, its length 1 ¾ in head.

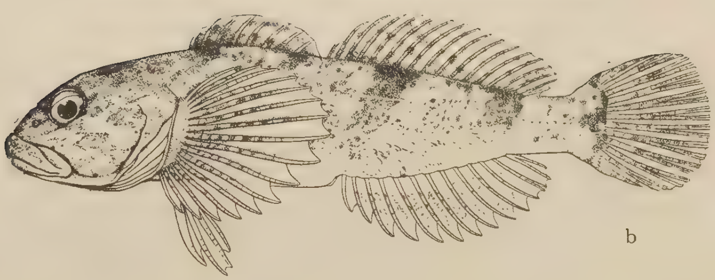
Body rough with small prickles; top of head appearing similar to body under a lens, but smooth to the touch.

Color brownisn or slate color on back and head, under parts white; sides crossed with 4 conspicuous, black, oblique, cross bars extending downward and slightly forward; one not evident as the others under front of spinous dorsal; one under fifth to seventh dorsal rays, growing narrower below and nearly reaching front of anal; a narrower one under last dorsal rays, and one across base of caudal; the rays of pectoral, dorsals, and caudal with black spots forming irregular bars across fins; anal and ventrals white; lips with black spots; chin dusky. Small specimens show a white crescent on nape in front of dorsal, the bars more conspicuous, and the interspaces lighter, sometimes white immediately behind bars from dorsal to lower parts.

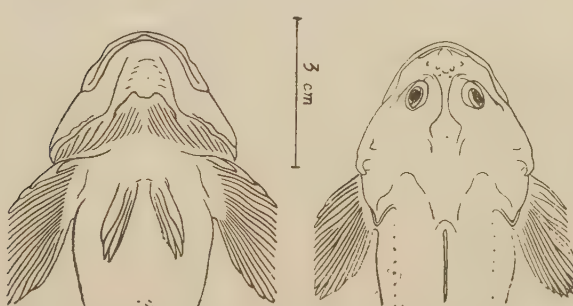
This species differs from *Uranidea reinii* (HILGENDORF) and *Uranidea dybowskii* (HILGENDORF) in having the ventral rays I, 4, in having 4 preopercular spines rather than 3, and in having teeth on the palate; from the former in having a large head, nasal spines developed, ventrals not nearly reaching



a



b



c–d

Text-figs. 120. a. ***Cottus kazika*** JORDAN et STARKS, from River Kuzuryû, Fukui Prefecture.
b. ***Cottus kazika*** JORDAN et STARKS, after M. WATANABE. ×½
c. ***Cottus kazika*** JORDAN et STARKS, (ventral side), after M. WATANABE.
d. ***Cottus kazika*** JORDAN et STARKS, (dorsal side), after M. WATANABE.

to anal and much shorter soft dorsal; from the latter in having the height of head much less (5 to 5½ rather than 3 ½ in length, without caudal). in having fewer pores in lateral line and in color, the conspicuous cross bars not being described. HILGENDORF describes 7 anal rays for *U. dybowskii*, which number is doubtless a misprint. Four specimens taken in the streams at Niigata and at Tsuruga; the largest, the type, is 9 cm. in length, the smallest 6 cm.

The type is numbered 7705, Ichthyological Collections, Leland Stanford Junior University Museum, and is from Niigata, where it was obtained by Mr. EITARO IIJIMA, a student in Stanford University. Cotypes are numbered 50918, U. S. N. M. (*Kajika*, the Japanese name of river sculpins.)

Habits: This species is endemic in Southern part of Japan. Along the sea coast of Japan Sea, it extends far north than the Pacific coast. This is dwelling stony river; omnivorous and spawns in winter. In this season, it descends river mouth. Youngs enter into sea and after growing up to some size, ascend rivers again.

In the breeding season, the mouth angle of the male is yellowish brown. The fish is a bottom feeder and likes to live in the clear current of the upper middle river with pebbly bottom. In the River Kuzuryu, Fukui Prefecture, before the spawning season at the end of November and in December, the fish descend the river into the mouth of the river, swimming near the surface of the current water. They migrate mostly over evening and night in the rainy swelling season. At the beginning of the migration the gonad is not yet ripened enough and in the end of December and January it may ripen and they spawn in the brakish water area around the mout of the river. They youngs grow 15–30mm. long by April and May and ascend the upper stream of the middle river.

Type locality: Niigata.

Distribution: Niigata; Tsuruga (JORDAN & STARKS); Wakayama Prefecture (UI); River Kuzuryû, Fukui Prefecture (OKADA & NAKAMURA); River Tama, Nishitama-gun, Tôkyô; River Tenryû, Handa-gun, Shizuoka Prefecture; River Banyû, Naka-gun,

Table 125. Measurement of *Cottus kazika* JORDAN et STARKS.

	Number of specimen	Maximum Value	Minimum Value	Mean Value
Total Length	15	19.7	5.6	11.8
Body Length	14	13.5	5.4	10.4
Number of Dorsal fin ray	14	IX–17	VIII–15	VIII–15
Number of Anal fin ray	14	15	14	15
Number of Pectoral fin ray	14	17	15	16
Number of Ventral fin ray	14	I–14	I–4	I–4
Scale number on Lateral line	14	36	34	35
Vertebrae number	6	7	4	6
Number of pyloric coeca	6	33	32	33
Body length/Head length	14	3.4	2.5	2.8
Body length/Body height	14	4.7	3.7	4.2
Headlength/Snout length	14	5.6	2.9	3.8
Head length/Head breadth	14	1.8	1.0	1.4
Head length/Internasal space	14	8.0	5.0	6.0
Head length/Caudal peduncle length	14	6.1	3.0	4.6
Head length/Caudal peduncle height	14	5.6	4.0	4.8
Head length/Pectoral fin length	14	1.8	1.1	1.5
Head length/Ventral fin length	13	2.8	1.8	2.3
Head length/Caudal fin length	14	2.4	1.3	1.9

Kanagawa Prefecture; River Kino, Kaiso-gun, Wakayama Prefecture; Kahokugata, Kahoku-gun, Ishikawa Prefecture; River Sufu, Naka-gun, Shimane Prefecture; River Kuzuryû, Sakai-gun, Fukui Prefecture; River Oi, Shita-gun, Shizuoka Prefecture. (WATANABE). River Mogami (HASHIMOTO, AOYAGI); Hamada, Shimane Prefecture (JORDAN, HUBBS); River Kôzu (AOYAGI); River Sagami; Odawada, Kanagawa Prefecture (JORDAN, STARKS); Yamanashi Prefecture (TANAKA); Tenryû River, Shizuoka Prefecture (OKANO); River Kiso (NIWA); River Kino, Wakayama Prefecture (TANAKA); Kyôto (MIYADI); River Yoshino, Kôchi Prefecture (TANAKA, KASAI); Kôchi Prefecture (TANAKA, KAMOHARA); Iwate Prefecture (KOYAMA).

Remarks: *Cottus kazika* JORDAN et STARKS is distributed all over Japan except Hokkaidô. That is widely distributing in freshwater and sometimes in brakish water as Ariake Bay, Fukuoka Prefecture, Kyûshû. WATANABE reported (1957) that the species is not found in Sado Island.

Cottus nozawae SNYDER is found in Hokkaidô. The author reported (1930) *Cottus pollux* is named for *Kazika* in Hokkaidô but WATANABE has not agreed. GUNTHER has found *Cottus pollux* from River Ishikari, Otaru in Hokkaidô. From his original description, WATANABE could not distinguish the young or adult and has some question for the species name described by GUNTHER, because the youngs of both species are very allied and could not distinguished themselves. Since then the *Cottus* found in Honshû and other district have not yet discovered in River Ishikari.

123. Cottus japonicus OKADA.

Sculpin, "Kajika"

(Text-figs. 121, a–e)

Cottus pollux ISHIKAWA. 1897, Prel. Cat., p. 42. – TANAKA, 1911, Fish Japan, pp. 1–2, pl. 1, figs. 1, 2, 3. – JORDAN et STARKS, 1904, Proc. U. S. Nat. Mus., XXVII, p. 267. – JORDAN et THOMPSON, 1914, Mem. Carn. Mus., vol. VI, no. 4, p. 277. – UI, 1932, Kisyu Gyofu, p. 231. – OKADA, UCHIDA MATSUBARA, 1935, Nihon Gyorui Zusetsu, p. 217, pl. 124, fig. 1. – MIYADI, 1935, Shinsyû Gyorui, p. 229, fig. 133. – MIYADI, 1935, Kyotofu Tansuigyo, pp. 41–42. – OKADA et IKEDA, 1938, Saitô Hô-on Kai Mus., Resear. Bull., No. 15, pp. 113–115, text-fig. 13, pl. VII, fig. 1. – OKADA et NAKAMURA, 1948, Nihon Tansuigyo, p. 200, fig. 132. – WATANABE, 1958, Stud. Cottid Fishes Japan, pp. 341–344, pl. 31, upper, pl. 82, figs. A–E, text-figs. 150–151.

Cottus hilgendorfi STEINDACHNER et DODERLEM, 1884, Beiträge zur Kennt. der Fische Japans, p 40, pl. IV, p. 40, pl. IV.

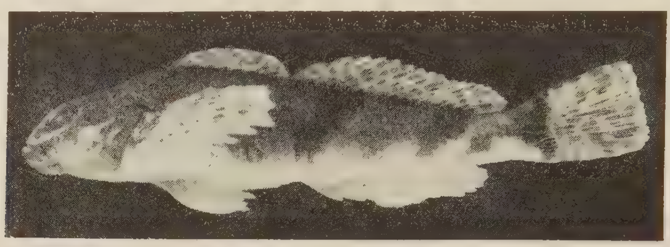
The original descripfion* is as follows:

Head 3¼ to 3⅖ in length without caudal; depth 5 to 5½. D. VIII or IX–16 to 18; anal 11 to 13. Eye 5 in head; maxillary 2 to 2⅖ in head; interorbital width ⅗ of eye; bone only ⅓ in eye.

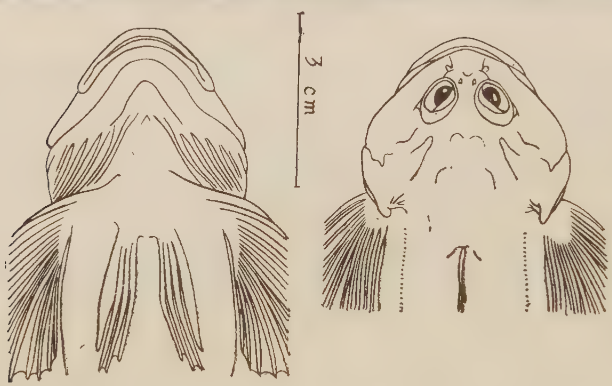
Body slender and head rather small. Teeth in moderate bands on jaws, narrower on vomer; pala-

*JORDAN et STARKS, 1904, Proc. Unit. St. Nat. Mus., vol. XXVII, no. 1358, pp. 267–268.

tines toothless. Lower jaw included. Maxillary variable with size; in the smaller examples (10 cm. long) it does not reach past posterior margin of pupil; in the larger ones (14 cm. long) it reaches to posterior border of eye. Preopercle with but one small hooked spine, usually covered by the skin; subopercle with a very small spine at anterior lower end. Interorbital concave; top of head evenly rounded.



a



b–c



d



e

Text-figs. 121. a. ***Cottus japonicus*** Okada, Okawa, Fukushima Prefecture.
b. ***Cottus japonicus*** Okada, (ventral side), after M. Watanabe (C. *pollux* G.)
c. ***Cottus japonicus*** Okada, (dorsal side), after M. Watanabe (C. *pollux* G.)
d. ***Cottus japonicus*** Okada, ♀ Lake Biwa.
c. ***Cottus japonicus*** Okada, ♂ Lake Biwa.

Length of ventrals variable; in the largest examples they nearly always reach to or cover the vent; in the smaller ones they sometimes reach to vent or sometimes to end within a distance of vent equal to the diameter of the eye. Pectoral reaches to opposite front of anal, its length 1 1/6 or 1 1/4 in head. Dorsal spines sle nder, the longest two-thirds or three-fourths of the longest soft rays. Longest anal rays 2 in head. Caudal slightly rounded; its length 1 1/2 in head. Skin everywhere perfectly smooth.

Color grayish or brown above, lighter or white below; back with 5 crossbars, the first under front of spinous dorsal, the next near posterior end of spinous dorsal, the others more conspicuous and longer, the middle one more oblique than the others, running from under the fourth to seventh dorsal rays, becoming narrower below and reaching obliquely forward to toward a point just in front of anal, the next bar under last dorsal rays and continued downward to light under parts, the fifth across base of caudal. Some specimens are uniform brown or gray above, shading rather suddenly but evenly to the lighter below; others especially the smaller ones are mottled with white and the line on lower parts between the light and the dark is much broken up and irregular, sometimes the back and the top of head plentifully sprinkled with small dark spots; the rays of the dorsals, pectoral, and caudal are spotted with dark, making irregular lines across fins; anal and ventrals usually white; sometimes on the large specimens there are a few spots on the anal rays and the tips of the ventrals are dusky.

Cottus hilgendorfi is certainly the same as *Cottus pollux.* The only alleged difference is that the former is said to have D. VIII-17 (VIII-18, in figure), instead of IX-19, and that the ventrals reach to within an eye diameter of the vent. All these variations are represented among our specimens. Our very many specimens are from the River Tana at Tachikawa near Tôkyô, from the River Sumida at Tôkyô, from the River Kitakami near Morioka, from the River Kinu at Utsunomiya, from Niigata in Echigo, from the river at Aomori, and from Kamashiro.

Description: Head $3\,^1/_4$ to $3\,^2/_5$ in length without caudal; depth of body 5 to $5\,^1/_2$. D. VIII or IX-16 to 18; P. 15; anal 11 to 13; V. $^3/_5$ of eye; snout $3\,^2/_3$ in head.

Body oblong, compressed; head rather small; interorbital rather narrow, slightly concave. Teeth villiform, in moderate bands on both jaws, narrower on vomer; palatines toothless. Maxillary variable with size, extending to vertical through posterior rim of eye. Preopercle with but one small hooked spine on upper edge, usually covered by the skin; subopercle with a very small spine at its anterior lower end. Interorbital concave; rather narrow, slightly concave; top of head evenly rounded.

Length of ventrals variable; in the largest examples they nearly always reach to or cover the vent; in the smaller ones they sometimes reach to vent or sometimes to end within a distance of vent equal to the diameter of eye. Pectoral reaches to opposite front of anal, its length $1\,^1/_6$ or $1\,^1/_4$ in head. Dorsal spines slender, the longest two-thirds or three-fourths of the longest soft rays. Longest anal rays 2 in head. Caudal broadly rounded posteriorly; its length $1\,^1/_2$ in head. Skin smooth.

Color grayish or brown above, lighter or white below; back with 5 cross-bars, the first under front of spinous dorsal, the next near posterior end of spinous dorsal, the others more conspicuous and longer, the middle one more oblique than the others, running from under the fourth to seventh dorsal rays, becoming narrow below and reaching obliquely forward to toward a point just in front of anal, the next bar under last dorsal rays and continued downward to light under parts, the fifth across base of caudal.

Habits: The present species is dwelling on bottom of rivers of Honshû (mostly abundant in northern part of Honshû). It likes clear waters, and deposits abhesive, yellow

or yellowish orange colored eggs under stones during April. Feeding on small animals as aquatic insects, molluscs and crustaceans.

Type locality: River Tama at Tachikawa near Tôkyô.

Distribution: River Tokazu (Ishikawa); River Tama, Tôkyô (Steindachner & Döderlein); Tsugaru; Uzen; Iwashiro; Shimotsuki; Chichibu; Yamashiro; Kai, River

Table 126. Measurements of *Cottus japonicus* Okada.

No. Sp.	Standard length	Depth body	Head	Snout	Eye	Depth caudal peduncle	Number of fin rays				
							D 1.	D 2.	A.	P.	V.
	mm.	in L.	in L.	in H.	in H.	in H.					
1033	49.0	5.3	3.1	3.5	3.7	3.3	IX	17	13	13	1.3
——	50.5	5.3	3.3	3.1	3.8	3.5	VIII	17+1	13	13	1.3
——	51.4	5.0	3.4	3.2	3.9	3.2	VIII	16+1	12+1	13	1.3
——	52.4	5.2	3.2	3.0	3.2	3.8	IX	17	13	13	1.3
——	63.2	5.3	3.2	3.1	3.6	3.6	IX	17+1	13	12	1.3
——	59.0	5.6	3.2	3.0	3.8	3.5	IX	17	13+1	13	1.3
——	78.1	5.1	3.1	2.9	4.5	3.7	IX	18+1	13+1	13	1.3
1116	54.1	4.8	3.5	2.9	3.7	3.0	IX	17+1	13	14	1.4
——	54.7	4.9	3.4	2.8	4.2	3.4	IX	17+1	13	12	1.3
5740	55.3	4.7	3.1	2.9	4.8	4.0	IX	16+1	12+1	14	1.3
——	73.3	5.2	3.1	2.9	4.9	3.9	IX	16+1	13	14	1.3
10035	59.8	4.5	3.2	3.2	4.8	4.1	IX	18+1	14	13	1.3
——	60.8	4.8	3.0	3.2	4.1	3.3	IX	17	13	14	1.3
11338	54.7	4.4	3.2	3.1	3.8	3.2	VIII	16	12	15	1.3
——	60.9	4.5	3.2	2.9	4.9	3.4	IX	17	13	14	1.3
15293	49.4	4.6	3.2	3.2	4.7	3.2	VIII	17+1	12	14	1.3
——	52.9	4.7	3.2	3.2	3.8	3.1	IX	16+1	13	14	1.3
——	54.1	4.9	3.2	3.1	4.7	3.4	IX	16+1	13	14	1.3
——	57.5	5.0	3.1	3.2	4.1	3.3	IX	16+1	12+1	14	1.3
——	61.0	5.1	3.3	3.3	4.6	3.0	IX	16+1	13	14	1.3
——	61.4	4.7	3.1	3.1	4.4	3.1	IX	16+1	12+1	14	1.3
——	66.6	4.7	3.1	3.0	4.2	3.1	VIII	16+1	12	13	1.3
——	69.9	4.6	3.0	3.2	4.5	3.2	VIII	16+1	12+1	14	1.3
——	76.4	4.5	3.3	3.4	4.7	3.2	IX	16+1	13	13	1.3
——	90.3	4.7	3.2	3.1	5.4	3.1	IX	16	12+1	14	1.3
17925	74.2	4.7	3.1	2.9	5.2	3.3	IX	16+1	12	14	1.3
18185	86.0	4.5	3.2	2.9	5.1	3.1	VIII	18+1	13+1	16	1.3
20134	89.4	4.8	3.2	3.2	5.5	3.1	IX	17+1	12+1	13	1.3
——	94.0	5.2	3.2	3.2	4.9	3.4	IX	17+1	13	13	1.3
26609	103.4	4.9	3.6	3.1	5.4	2.9	IX	17+1	13+1	?	1.3
20135	56.3	5.1	3.7	3.1	4.6	2.8	IX	17+1	13+1	13	1.3
——	73.7	4.6	3.7	3.2	4.5	2.8	VIII	17+1	12	13	1.3

Kamo, River Katsura; Tôkyô (Ishikawa); River Tama; Tachikawa, Tôkyô; River Sumida; Tôkyô; River Kitakami, Morioka; River Kinu, Utsunomiya; Niigata; Echigo; Aomori; Kamashiro (Jordan & Starks); Hokkaidô; Honshû mostly in Northern Honshû (Okada, Uchida, Matsubara); Maya, Higashitori-mura, Shimokita-gun, Aomori Prefecture; Hirosaki, Aomori Prefecture; Otate-machi, Kita-Akita-gun, Akita Prefecture; River Shizukiishi, Iwate-gun, Iwate Prefecture; River Sarugaishi, Hareyama, Waga-gun, Iwate Prefecture; River Arao, Onikobe-mura, Tamatsukurigun, Miyagi Prefecture; River Arao, Onikobe-mura, Tamatsukuri-gun, Miyagi Prefecture; Kawatari-mura, Tamatsukuri-gun, Miyagi Prefecture; River Hirose, Sendai, Miyagi Prefecture; River Aka, Higashi Tagawa-gun, Yamagata Prefecture; Kitakata, Yama-gun, Fukushi-

ma Prefecture (OKADA & IKEDA); Wakayama Prefecture (UI); Takematsu village Nagasaki Prefecture (TANAKA); Misaki; Lake Biwa, Matsubara (JORDAN & THOMPSON); Kyôto (MIYADI); River Chikugo, Kumamoto Prefecture (AOYAGI); River Tama, Kumamoto Prefecture (OGAWA); River Ôhata, Aomori Prefecture (AOYAGI); River Kino, Wakayama Prefecture (TANAKA); Lake Biwa, Shiga Prefecture (TANAKA & MIYADI); Okayama Prefecture (TANAKA & KASAI); River Sekii, Miyako City, Iwate Prefecture; River Hagoro, Kitamurayama-gun, Yamagata Prefecture; River Koshi, Kamaishigun, Iwate-Prefecture (WATANABE) River Kôzu, Shimane Prefecture (AOAGI); Nagasaki (TANAKA): River Tokachi; River Atsuta; River Chitose; Utonai Swamp (ISHIKAWA, MATSUURA GUNTHER, SOEDA); Morioka, Iwate Prefecture (KOYAMA).

Table 127. Measurements of *Cottus japonicus* OKADA.

Collection	Fish. Mish. Univ.*		
Total length	105.0mm.	110.0mm.	95.8mm.
Body length	87.0	90.0	76.0
Body length/Head	3.41	3.23	3.80
Body length/Depth	5.05	4.28	4.52
Body length/Predorsal length	3.11	3.10	3.23
Body length/Prepectoral length	3.16	3.21	3.65
Body length/Preventral length	3.48	3.43	3.45
Body length Preanal length	1.69	1.73	1.77
Head/Snout	4.30	4.64	7.22
Head/Upper jaw	2.55	2.48	2.22
Head Interorbital width	6.90	6.37	6.70
Head/Diameter of Eye	4.81	4.08	4.04
Head/Length of Caudal peduncle	1.85	1.85	1.76
Head/Depth of Caudal peduncle	2.69	3.02	2.40
Head/Length of Dorsal fin I	1.42	1.32	1.06
Head/Length of Dorsal fin II	0.85	0.90	0.72
Head/Length of Anal fin	1.24	1.21	1.01
Head/Height of Dorsal fin I	3.36	3.48	2.62
Head/Height of Dorsal fin II	2.16	2.32	1.84
Head/Height ef Anal fin	1.89	2.14	1.73
Head/Pectoral length	1.17	1.27	0.95
Head/Ventral length	1.42	1.60	1.24
Date	VIII, 1955		
Locality	River Machiya, Mie Prefecture		

*Faculty of Fisheries, Prefectural University of Mie.

Remarks: *Cottus pollux* was originally mentioned by GUNTHER in 1873 the type specimen from River Ishikari, Hokkaidô and that species is somewhat different from the species from Honshû and other localities except Hokkaidô. In 1911, SNYDER described *Cottus nozawae* from the specimen collected at River Ishikari, Sapporo, Hokkaidô but that species is quite same to *Cottus pollux*. From this standpoint, the author took *Cottus nozawae* under the synonyme of *Cottus pollux*. Under the consideration mentioned above, the specific name *Cottus pollux* must be changed into a new name *Cottus japonicus*. JORDAN and HUBBS (1925) mentiond that in the present species the number of fin ray varies considerably, both individually and geographically. GUNTHER (1873) noted that the

present species was obtained at River Ishikari, Hokkaidô, but the author has not yet discovered it in Hokkaidô. The author has suggested that in Hokkaidô, the southern coast of the Sea of Japan, and to be very scarce or not.

124. **Cottus hangiongensis** Mori.

"Kitanokazika"

(Text-figs. 122, a–c)

Cottus hangiongensis Mori, 1930, Journ. Chôsen Nat. Hist. Soc, no. 11. pp. 39.-40, pl. III. - Sato et Kobayashi, 1951, p. 129, fig. 2. - Watanabe 1958, Stud. Cottid Fish, Japan, pp. 347-351, pl. 32, pl. 84, A-I, text-figs. 156-156.

The original description* is as follows;

Cottus hangiongensis sp. nov.

D. VIII, 21; A. 16; P. 14; V.l, 4.

Head 3.7 in body length; depth 5.0; eye 4.0 in head; snout 3.9; interorbital space 7.2; depth of caudal peduncle 3.2; pectoral 1.1; ventral 1.4.

Body slender and compressed. Head depressed, snout narrow, a notch in profile in front of eyes; maxillary reaching to below centre of pupil; teeth in broad bands on jaws, narrower on vomer; palatines toothless; preopercle with only one stout spine, usually covered by skin, subopercle with a very small spine at its anterior lower end; interorbital space concave and continuous behind with a narrow shallow concave area on top of head; nasal spine rather obtuse; lateral line above the middle of body, reaching to caudal and terminating near extremity of dorsal.

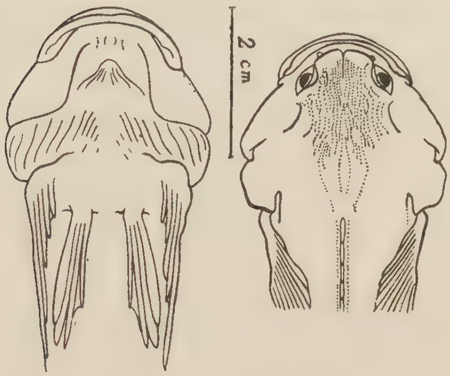
Origin of spinous dorsal a little behind tip of opercular flap, its base 1.4 in head, its longest spine two-thirds of length of longest soft ray, soft rayed dorsal reaching far backward; origin of anal under third dorsal ray, and last anal ray under sixteenth dorsal ray, and its base shorter than soft dorsal base; pectoral reaching to anal; ventral with one concealed spine and four rays, their tips not reaching to anus; caudal slightly rounded, its length 1.3 in head; skin smooth.

Colour in formalin brownish on sides and upper parts, under parts white; five dark indistinct crossbars on back above lateral line, one under spinous dorsal, three under soft dorsal and one on caudal base, these sometimes conspicuous, sometimes so broken up and mixed in with general mottling of back and sides as to be obscure. Total length 117 mm. This description is made of a specimen from Kai-nei. This species allied to *C. poecilops* Heckel and *C. czerskii* Berg, but differing from these in having numerous dorsal and anal soft rays.

I have four specimens Kai-nei, 117-150 mm. long.

Description: Body slender, moderately compressed; head depressed, rounded at end. Interorbital space narrow, flattened. Nostrils separated from each others, with small process. Eyes somewhat large, located to dorsal, high. Mouth horizontal; two jaws nearly equal in length, maxillary not reaching anterior margin of eye. Small villiform teeth on jaws and vomer, but not on palatine. Preopercle with short spine on upper posterior angle. Gill membrane united with isthmus. Gill rakers granular. Dorsals

*T. Mori, 1930, Journ. Chosen Nat. Hist, No. 11, pp. 39-40, pl. III.



a–b



c

Text-figs. 122. a. ***Cottus hangiongensis*** MORI, (ventral side), after M. WATANABE.
b. ***Cottus hangiongensis*** MORI, (dorsal side), after M. WATANABE.
c. ***Cottus hangiongensis*** MORI.

Table 128. Measurements of *Cottus hangiongensis* MORI*.

	Number of Specimens	Maximum Value	Minimum Value	Mean Value
Body Length	16	11.5	5.1	8.3
Number of Dorsal fin ray	16	XI–22	IX–16	IX–20
Number of Anal fin ray	16	18	12	15
Number of Pectoral fin ray	16	15	13	14
Number of Ventral fin ray	16	1–4	1–4	1–4
Scales on Lateral line	8	38	36	37
Number of Gill raker	13	10	7	9
Number of Vertebrae	4	37	36	36
Number of Pyloric coeca	5	5	4	4
Body length/Head length	13	4.5	3.2	3.7
Body length/Body height	13	6.4	4.5	5.4
Head length/Snout length	13	4.0	3.1	4.6
Head length/Body breadth	13	1.6	1.3	1.4
Head length/Eye diameter	13	5.5	4.3	4.7
Head length/Interorbital space	13	8.7	6.0	7.5
Head length/Caudal peduncle length	13	5.8	3.0	4.3
Head length/Caudal peduncle height	13	3.4	3.0	3.2
Head length/Pectoral fin length	13	1.2	1.0	1.0
Head length/Ventral fin length	13	1.5	1.3	1.4
Head length/Caudal fin length	13	3.4	2.4	2.8

*This measurement was made by M. WATANABE.

close together; first one arising far behind posterior end of gill membrane; second one not reaching the base of caudal at posterior end with third longest ray. Anal opposing to second dorsal, inserted just behind the second dorsal ray. Pectoral inserted just beneath preopercle. Ventral inserted behind it and reaching base of anal fin. Anus corresponding in its site to fore end of second dorsal. Caudal somewhat rounded posterorly; caudal peduncle short, narrower than high. Interorbital region and head with many fine cross bands intermingle with granules. Arm pit with small granular, degenerate scales.

Coloration: In formalin, body pale brownish grey. Head more or less darker. Two irregular black bands present below first dorsal fin, three below second one on caudal peduncle. First dorsal and pectorals with black several stripes.

Distribution: River Atsuta, Ishikari-gun, Hokkaidô; River Mobechi, Kamitso-gun, Hokkaidô, (WATANABE).

125. Cottus reinii HILGENDORF.
"Utsusemi kazika"
(Text-figs. 123, a–c)

Cottus reinii HILGENDORF, 1879, Sitz. Gesell. Natur. Freu. Berlin, p. 105. – JORDAN, TANAKA et SNYDER, 1913, p. 264. – OKADA et NAKAMURA, 1948, Nihon Tansuigyo, pp. 199–200, fig. 131. – WATANABE, 1958, Stud. Cottid Fish. Japan, pp. 344–347, pl. 31, lower; pl. 83, A–H, text-figs. 152–154.
Uranidea reinii JORDAN et STARKS, 1904, Proc. U. S. Nat. Mus., vol. XXVII, no. 1358, pp. 268–269. – OKADA et IKEDA, 1934, Sci. Rep. Tokyô Bunrika Daig. Sect. B, no. 28, p. 152.

The original description* is as follows:

Cottus reinii. n. sp.
Br. 6, D. 9/1–20, A. 13–15, P. 13–16, V. 1/3

Vormerzähne. Haut auf dem Kopfe mit erhabenen Punkten, über der P. mit feinen Stacheln Keine Dornen auf der Schnauze; Praeoperculum mit 3 Dornen, der obertte einfach, nach hinten und etwas nach oben gebogen, die beiden unteren nach vorn gerichtet; Suboperculum mit einem nach vorn gewandten Stachel an der Vorderecke. Seitenlinien vollständig. After von der Schnauzenspitze etwas weiter entfernt als von der Wurzel der Caudalis. V. bis zum After reichend; D. I. 3/4 so hoch als D. II. Die Kiemenhaut zieht nicht ununterbrochen über den Isthmus fort. Korperhöne in Länge (ohne C.) 5 1/3 mal, Kopfl. in Körperl 3 1/2 mal, Augen durchm. etwas kleiner als die Schnauzenlange und etwas grösser als bie Interorbitarbreite; das Maxillare reicht etwas hinter die Augenmitte.

Farbe chokoladen braun mit dunkleren Punktflecken und mehreren unregelmassigen Querbriden; Flossen mit Punktflecken.

Insel Yeso und Südnippon; Süsswasser.

Jungere Exemplare von Yeso haben kürzere Bauchflossen und Oberkiefer und kleinere Interorbitalbr. Das Exemplar von Südnippon (durch Prof. RENI mir gütigst mitgetheilt) ermangelt ausserdem der Rauhigkeiten auf dem Kopf und an den Seiten. Mus. Ber. No. 10629.

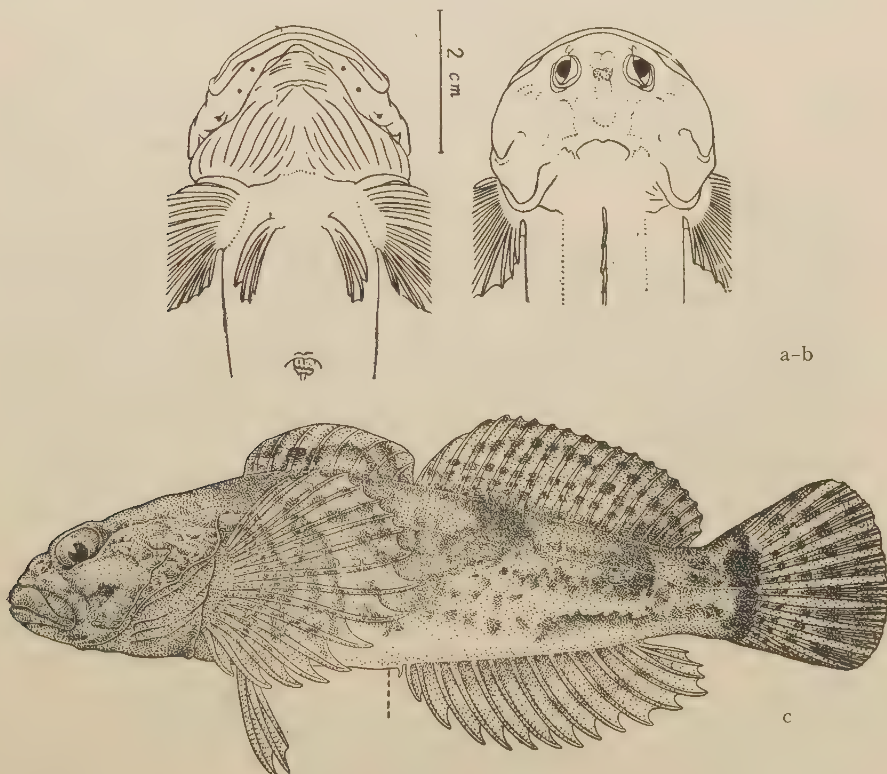
*HILGENDORF, F., 1879, Sitz. Gesell. Natur. Freu. Berlin, p. 105.

Description: Head $3\,^1/_2$ in length, without caudal; depth of head $5\,^1/_3$. Dorsal IX, 17 to 20; and 13 to 15; pectoral 13 to 16; ventral 1, 3.

Vomer toothed. Skin of head with raised points; over the pectoral are fine prickles; no spines on snout. Preopercle with 3 spines, the upper one simple and curved, the two lower ones directed forward; subopercle with a covered spine on the lower anterior edge. Lateral line complete. Front of anal somewhat farther from the tip of the snout than from the base of caudal. Ventral reaches to anal. Spinous dorsal three-fourths as high as the soft dorsal. Gill membrane not continuous across isthmus. Diameter of eye somewhat less than length of snout, and somewhat greater than interorbital width. The maxillary reaches to somewhat behind the middle of the eye.

Color chocolate brown with darker spots and several irregular cross bars; fins with spots.

Habits: This is distributing in Honshû and dwelling in stony rivers. Spawning in May, depositing eggs under stones. Feeding on insect larva and small fishes.



Text-figs. 123 a. ***Cottus reinii*** HILGENDORF, (ventral side), after M. WATANABE.
b. ***Cottus reinii*** HILGENDORF, (dorsal side), after M. WATANABE.
c. ***Cottus reinii*** HILGENDORF, after M. WATANABE.

Table 129. Measurements of *Cottus reinii* HILGENDORF.*

	Number of Specimens	Maximum Value	Minimum Value	Mean Value
Body Length	46	11.4	7.0	9.5
Number of Dorsal fin ray	46	IX–19	VIII–16	IX–17
Number of Anal finray	46	13.0	11.0	13.0
Number of Pectoral fin ray	46	14.0	12.0	13.0
Number of Ventral fin ray	46	2–4	1–3	1–4
Scales on Lateral line	45	38.0	28.0	35.0
Number of Gill raker	46	5.0	3.0	4.0
Number of Vertebrae	8	35.0	33.0	35.0
Number of Pyloric coeca	8	5.0	4.0	4.0
Body length/Head length	46	4.0	3.0	3.5
Body length/Body height	46	5.8	4.0	4.6
Head length/Snout length	46	8.4	1.8	2.1
Head length/Body breadth	46	2.0	1.0	1.3
Head length/Eye diameter	46	6.8	4.2	5.2
Head length/Interorbital space	46	8.7	5.2	6.7
Head length/Caudal peduncle length	46	3.1	2.0	2.5
Head length/Caudal peduncle height	46	3.8	2.4	2.9
Head length/Pectoral fin length	46	1.7	1.0	1.2
Head length/Ventral fin length	46	1.9	1.3	1.6
Head length/Caudal fin length	46	1.9	1.3	1.5

*These measuremnts were made by M. WATANABE.

Table 130. Measurements of *Cottus reinii* HILGENDORF.

Collection	O. H. B. S.*	
Total length	13.5mm.	9.5mm.
Body length	11.4	8.4
Body length/Head	2.65	3.23
Body length/Depth	4.38	4.94
Body length/Predorsal length	2.48	2.80
Body length/Prepectoral length	2.92	3.36
Body length/Preventral length	2.48	3.23
Body length/Preanal length	1.68	1.95
Head/Snout	3.58	2.89
Head/Upper jaw	1.87	2.36
Head/Interorbital width	7.16	5.78
Head/Diameter of Eye	4.98	5.20
Head/Length of Caudal peduncle	2.53	2.17
Head/Depth of Caudal peduncle	4.30	3.71
Head/Length of Dorsal fin I	1.59	1.44
Head/Length of Dorsal fin II	1.07	0.87
Head/Length of Anal fin	1.59	1.63
Head/Height of Dorsal fin I	4.78	3.25
Head/Height of Dorsal fin II	3.91	2.89
Head/Height of Anal fin	2.86	2.60
Head/Pectoral length	1.39	1.24
Head/Ventral length	1.39	1.30
Date	V. 1915	
Locality	Ishikari, Hokkaidô	

*Otsu Hydrobiological Station attached to Kyôto University.

Distribution: River China, River Azumi, Takashiwa-gun, Shiga Prefecture, River Tama, Saitama-gun, Tôkyô (WATANABE).

Genus **Trachidermus** HECKEL, 1840.

Trachidermus HECKEL, Ann. Wiener Mus. II, 1840, p. 159. not *Trachyderma.*
Centridermichthys RICHARDSON, Voyage Sulphur, Fishes, 1846, p. 73.

Characters: Head much depressed bearing ridges covered by a moderately thick skin; 2 ridges on each side of top of head from behind eye, diverging backward; a ridge on opercle, and a prominent one on suborbital stay; spine at angle of preopercle very much hooked and having the gill membrane more narrowly connected to isthmus. It has teeth on jaws, vomer, and palatines; branchiostegals 6; no slit behind last gill arch; origin of anal behind middle of entire length, and skin usually with prickles; lower pectoral rays simple. Ventral rays I, 4. Mountain streams of southern Japan, China, and the Philippines.

126. **Trachidermus fasciatus** HECKEL.

Mountain witch, "Yama-no kami, Ayukake"

(Text-figs. 124, a–c)

Trachidermus fasciatus HECKEL, Ann. Wiener Mus., II, 1840, p. 160, pl. ix, figs. 1, 2; – TANAKA, 1924, p. 613, pl. 149, figs. 410, 411. – WATANABE, 1958, Stud. Cottid Fish. Japan, pp. 331–33, pl. 25, lower, pl. 79, text-figs. 142, 143.

Centridermichthys fasciatus GÜNTHER, Cat. Fish., II, 1860, p. 170, copied. – ISHIKAWA, 1897, Prel. Cat., p. 48.

Cottus uncinatus SCHLEGEL, Fauna Japonica Poiss., 1843, p. 38.

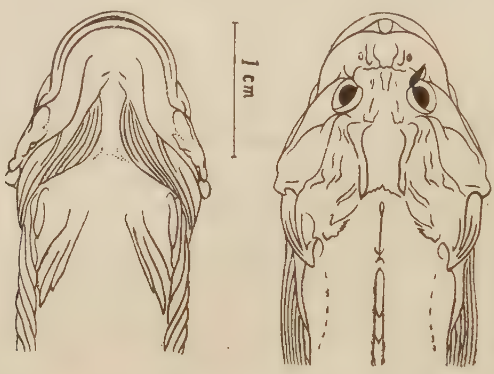
Centridermichthys ansatus RICHARDSON, Voyage of Sulphur, Fishes, 1844, p. 74, pl. LIV, figs. 6–10.

Trachydermus ansatus JORDAN et STARKS. 1904, Proc. Unit. Stat. Mns., vol. XXVII, no. 1358, pp. 262–264, fig. 14.

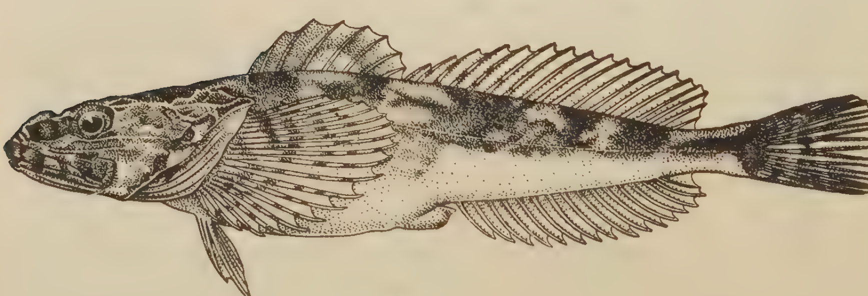
Description: Head $2\,^1/_2$ to $2\,^3/_5$ in length without caudal; depth $5\,^1/_2$; dorsal XII, 12; anal III, 9; eye $5\,^1/_3$ to $5\,^1/_2$ in head; interorbital width $6\,^1/_2$ to 7; maxillary $2\,^1/_6$. B. 6; D. IX–19; A. 17; P. 8, 9; V. 1, 4; C. 9, 13. 9.

Body rather elongate, upper and lower outlines equally and slightly arched; subcylindrical at base of pectoral, strongly compressed posteriorly. Head depressed, nearly twice as wide as deep; eye small, high up, entirely on anterior half of head; interorbital rather wide, concave, and without ridges, continuous with a wide concave area on top of head between ridges from eyes, superorbital rim very much widened posteriorly. From each eye a pair of ridges run backward which are covered by moderately thick skin; the inner ridge diverges from the outer one toward its fellow of the opposite side and ends in a small blunt spine at each side of occiput; the outer ridge runs along pterotic region and ends without a spine. Nostrils two; anterior one tubular, almost midway between edge of preorbital and eye; posterior nosterior nostril a little smaller, slightly tubular, above anterior rim of eye; preorbital rather wide. Mouth subhorizontal, large, with lateral cleft; maxillary exposed posteriorly, extending to vertical through centre of eye; lower jaw included. Teeth in jaws villiform, in rather wide bands ante-

riorly; laterally becoming narrower band in upper jaw and in two rows in the lower; of the lower teeth outer ones much smaller; villiform teeth on vomer and palatines in bands, those on the latter in two narrow bands. Opercle with a rather strong ridge and a strong wide ridge runs along the suborbital stay and ends at the upper preopercle spine. Nasal spines scarcely developed, not projecting through the skin. Preopercle with 4 spines; the upper larger than the others and very strongly hooked; the two next below rather blunt and directed downward backward, the lowest one hooked forward. Gill openings wide, the membranes not continued forward beneath, rather narrowly joined to the isthmus; gills 4 in number, no slit behind the last; pseudobranchiae developed; gill-rakers on first gill-arch stumpy, $1+9$ in number.



a–b



Text-figs. 124. a. ***Trachidermus fasciatus*** Heckel, (ventral side), after M. Watanabe.
b. ***Trachidermus fasciatus*** Heckel, (dorsal side), after M. Watanabe.
c. ***Trachidermus fasciatus*** Heckel.

Pectoral reaches to front of anal; it has 18 rays, the lower 10 simple, the upper ones divided once; the fifth ray and three below are the longest, one and half in head. Ventrals with one concealed spine and four rays; their tips reach half way from their base to front of anal. First dorsal inserted over base of pectoral, rounded in free margin, second dorsal scarcely separated from the first by a deep notch, its rays subequal in length, posterior rays reaching to base of caudal when depressed posteriorly; anal in-

serted below third ray of second dorsal, similar in form to the latter fin, caudal subtruncate when folded, but broadly rounded when expanded outward.

Table 131. Measurements of *Trachidermus fasciatus* HECKEL.*

	Specimen Number	Maximum Value	Minimum Value	Mean Value
Total length	6	11.0	14.3	13.0
Body length	6	11.8	9.8	10.9
Number of Dorsal fin ray	6	VIII–19	VIII–18	VIII–19
Number of Anal fin ray	6	17.0	16.0	17.0
Number of Pectoral fin ray	6	17.0	16.0	16.0
Number of Ventral fin ray	6	I–4	I–4	I–4
Number of scales on Lateral line	6	40.0	38.0	37.0
Number of Vertebrae	3	36.0	34.0	35.0
Number of Pyloric coeca	ε	5.0	4.0	5.0
Body length/Head length	6	2.8	2.5	2.7
Body length/Body height	6	6.0	4.2	5.3
Body length/Snout length	6	3.4	2.7	3.2
Body length/Head breadth	6	1.5	1.1	1.4
Head length/Body breadth	6	1.6	1.2	1.4
Head length/Eye diameter	6	7.3	5.6	6.7
Head length/Interorbital space	6	7.0	4.9	5.6
Head length/Caudal peduncle length	6	7.0	5.6	6.2
Head length/Caudal peduncle height	6	7.0	5.6	6.2
Head length/Pectoral fin length	6	1.7	1.3	1.5
Head length/Ventral fin length	6	3.1	2.2	2.6
Head length/Caudal fin length	6	2.3	1.9	2.1

*This measurement was made by M. WATANABE on the specimens collected at River Chikugo, Kumamoto Prefecture.

Color in formalin grayish brown on back, white below, back and sides crossed by five slightly oblique crossbars from back forward and downward; the first very wide, ceasing abruptly downward, but upward continuing with a wide blotch which extends on first dorsal between first and fifth spines; second beneath seventh anal eighth spines of dorsal, very short and narrow, inconspicuous; third and fourth beneath second dorsal, extending a little way below lateral line; a dark blotch at base of caudal a dark line on interorbital extending into iris of eye; a broad band across cheek to near lower preopercular spines; a band running forward from eye beyond snout to anterior part of mandible; another but rather inconspicuous line from lower and posterior border of eye running obliquely downward and backward and to near upper end of preopercle. Ventrals and anal white; other fins with irregular cross lines, formed by light brown spots on rays; a dark spot on base of pectoral and first three or four spines of dorsal with a large black spot.

Color in fresh, vertical bar of deep scarlet with yellow dashes on the skin under preopercle partly covered by that bone, this bar extending on upper branchiostegal rays. Fins and body light and dark olive.

Habits: The breeding season occurs in December and January in the Chikugo and Yabe river areas. Before spawning, the adult ascends the rivers and then deposits eggs on shells in the brakish water, around the mouth of the river. After spawning, the male and female protect eggs together. The young grows 30 mm. long by June and

ascends into the upper river.

Distribution: River Chikugo; River Yabe, Kumamoto Prefecture (AOYAGI); Rivers around Ariake Bay (AOYAGI); River Yana, Kurume, Fukuoka Prefecture; Saga, Kumamoto Prefecture (TANAKA); Chikugo River, Misumi-gun, Fukuoka Prefecture; River Kase, Koshiro-gun, Saga Prefecture (WATANABE); Saga, Kyûshû (TANAKA).

Order Pleuronectida

Characters: Body deep, strongly compressed, with the eye side, turned upwards and the blind side downwards. Dorsal and anal long, occupying greater part of the body. Branchiostegal rays 6–8. Pseudobranchiae present or wanting. Air-bladder generally wanting. Pyloric coeca few or wanting.

Suborder Pleuronectina

Characters: Dorsal fin inserted from front dorsal of eye, without spine; dorsal fin with 3–13 soft ray. Eye dextral or sinistral.

Family Pleuronectidae

Characters: Body strongly compressed, oval or elliptical in outline; head unsymmetrical, the cranium twisted, both eyes being on the same side of the body, which is horizontal in life, the eyeside being uppermost and colored, the blind side lowermost and usually plain. In the very young fish the bones of the head are symmetrical, one eye on each side, and the body is vertical in the water. In most species the cranium becomes twisted, bringing the upper eye over with it. Eyes large, well separated; mouth small or large, the dentition various, the teeth always present; premaxillaries protractile; no supplemental maxillary bone; pseudo-branchiae present; gills 4, a slit behind the fourth; lower pharyngeals separate; no air-bladder; preopercle with its margin usually distinct; not wholly adnate or hidden by the skin of the head; vent not far behind head, the viscera confined to the anterior part of the body; scales various, rarely absent, usually small; lateral lines usually present, extending on the caudal fin, sometimes duplicated or wanting. Dorsal fin long, continuous, of soft rays only, beginning on the head; anal similar, shorter, caudal various, sometimes coalescent with dorsal and anal; pectorals inserted rather high, rarely wanting; ventrals thoracic under the pectorals, usually of several soft rays, one of them sometimes wanting.

Genus Platichthys GIRARD, 1854.

Platichthys GIRARD, 1854, Proc. Ac. Nat. Sci. Phila., p. 136.

Type .... **Platichthys rugosus.**

Characters: Body very robust, broad, not greatly comprssed. Mouth small; teeth chiefly uniserial, incisor-like. Scales all in both sexes and on both sides of body reduced to coarse scattered stellate tubercles, which are not imbricated; similar tubercles between batween bases of dorsal and anal rays; lateral line without scales, with no anterior arch or accessory lateral line; lower pharyngeals broad, each with 3 rows of blunt coarse teeth.

127. Platichthys stellatus (PALLAS).

"Kawa-garei"

(Text-fig. 125)

Pleuronectes stellatus PALLAS, 1811, Zoographia Rbsso-Asiatica, III, p. 416. – GÜNTHER, 1862, Cat. Fish., LV, p. 443. - STEINDACHNER, 1870, Pleur. von Decastris Bay, p. 1. – JORDAN et GILBERT, 1880, Proc. U. S. Nat. Mus., III, p. 453, – GILBERT, 1881, Proc. U. S. Nat. Mus., IV, p. 420. – JORDAN et GILBERT, 1883, Synopsis, p. 835. – BEAN, 1883, Proc. U. S. Nat. Mus., VI, p. 353. – BEAN, 1883, Cat. Coll. Fish., U. S. Mus., p. 20. – JORDAN, 1897, Nat. Hist. Aquat. Anim., p. 184, pl. XLVI. – O-TAKI, 1897, Journ. Bureau Fish., p. 7, pl. VI, fig. 6.

Platessa stellata DE KEY, 1842, N. Y. Fauna, Fishes, p. 301. – STORER, 1846, Synopsis, p. 478.

Platichthys stellatus LOCKINGTON, 1878–79, Rep. Com. Fish. Cal., p. 43. – LOCKINGTON, 1879, Proc. U. S. Nat. Mus., p. 91. – JORDAN, et GOSS, 1889, Review Flounders & Soles, p. 296. – JORDAN et GILBERT, 1898, Fur Seal Explr. III, p. 492. – JORDAN et EVERMANN, 1898, Fish. North. Mid. Am., III, p. 2652. – JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., XXIII, p. 379. – SCHMIDT, 1904, Faune Pisc. Mar. Orient, p. 240. – JORDAN et STARKS, 1906, Proc, U. S. Nat. Mus., vol. XXXI, no. 1484, pp. 218–219, fig. 19. – TANAKA, 1908, Ann. Zool. Jap., vol. VI, pt. 4, p. 254. – OKADA, UCHIDA et MATSUBARA, 1935, Nihon Gyorui Zusetsu, p. 243, pl. 143, figs. 1–2. – OKADA et IKEDA, 1938, Sci. Rep. Tokyo Bun. Daig., sect. B, no. 55, p. 154. – OKADA et IKEDA, 1938, Saito Ho-onkai Mus., Resear. Bull., no. 15, pp. 120–121.

Platichthys rugosus GIRARD, 1854, Proc. Ac. Nat. Sci. Phila., pp. 139, 155. – GILBERT, 1858, U. S. Pac. R. R. Surv., X, Fishes, p. 148.



Text-fig. 125. ***Platichthys stellatus*** (PALLAS).

Description: Head 3; depth 2. D. 58; A. 42. Vertebrae, 34. Body broad and short, the snout forming a slight angle with the profile; lower jaw projecting; interocular space rather broad, with very rather rough scales; large rough scales at base of dorsal and anal rays and on sides of head; similar but smaller scales scattered over the body; lateral line smooth; fins without scales; a cluster of bony prominences above opercle. Teeth incisor-like, truncate, rather broad, 10 + 15/12 + 16. Lower pharyngeals broad, with coarse paved teeth.

Dark brown or nearly black, with lighter markings; fins reddish brown; dorsal and anal with 4 or 5 vertical black bands; caudal with 3 or 4 black longitudinal bands.

Type locality: Kamtchatka, Aleutian & Kuril Islands.

Table 132. Measurements of *Platichthys stellatus* (PALLAS).

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total length	122. 0mm.	Head/Interorbital width	11. 00
Body length	98. 0	Head/Diameter of Eye	8. 25
Body length/Head	2. 97	Head/Length of Caudal peduncle	3. 30
Body length/Depth	1. 78	Head/Depth of Caudal peduncle	3. 00
Body length/Predorsal length	4. 08	Head/Length of Dorsal fin	0. 47
Body length/Prepectoral length	3. 16	Head/Length of Anal fin	0. 56
Body length/Preventral length	2. 8–	Head/Height of Dorsal fin	3. 30
Body length/Preanal length	2. 13	Head/Height of Anal fin	3030
Head/Snout	4. 13	Head/Pectoral lngth	2. 20
Head/Upper jaw	3. 30	Head/Ventral lngth	3. 30
Date	X, 1928		
Locality	Lake Komuke, Hokkaidô		

*Ôtsu Hydrobiological Station, atuched to Kyôto University

Distribution: Northern Japan (ÔTAKI); Hokkaidô (ISHIKAWA); Japan Sea; Hakodate (SCHMIDT); Muroran; Hakodate; Aomori; Same; Matsushima; Tôkyô (JORDAN & STARKS); Every where in Hokkaidô; Northern part of Japan (OKADA & IKEDA); Chipesain, Lake Busse; mouth of River Susuya, Sakhalin; Nagoro, Hokkaidô (TANAKA); Kasumigaura, Ibaraki Prefecture (HIKITA); Obama, Fukui Prefecture (HIKITA).

Remarks: The present species is found abundantly in the brakish waters of North Japan, and it is highly probable that its southern limit is Kasumigaura on the Pacific coast, and Niigata Prefecture on the coast of the Sea of Japan.

It is dwellng in the entrance of river and in lakes, sometimes ascends into rivers. It spawns during February and March in the western coast of Hokkaidô.

Genus **Kareius** JORDAN et SNYDER, 1900.

Kareius JORDAN et SNYDER, 1900, Proc. U. S. Nat. Mus., xxiii, p. 379.

Type- .... **Kareius scutifer**

Characters: This genus is allied to *Pleuronectes* and *Lipselta*, differing in the scaleless body, the adult having two or three irregular bony or warty areas an the eye side. Teeth even, in one row.

128. Kareius bicoloratus (Basilewsky).

"Ishigarei"

(Text-fig. 126)

Platessa bicoloratus Basilewsky, 1855, Nom. Mem. Soc. Moscow, x, p. 260.

Pleuronectes scutifer Steindachner, 1870, Sitzber. Akad. Wiss. Wien, xxi, p. 628, pl. 11. – Otaki, 1897, Journ. Bur. Fish, vii, pl. vi, fig. 5.

Pleuronectes bicoloratus Herzenstein, 1890, Bull. Ac. Sci. Petersh., p. 133.

Kareius bicoloratus Jordan et Snyder, 1901, Prel. Check list Fish. Japan, p. 122. Schmidt, 1904, Pisc. Mar. Orient, p. 243. – Jordan et Starks, 1906, Proc. U. S. Nat. Mus., vol. xxxi, no. 1484, pp. 220–221. – Tanaka, 1925, Fish. Japan, pp. 192–195, pl. lii, fig. 198.

Kareius scutifer Jordan et Snyder, 1901, Proc. U. S. Nat. Mus., xxiii, p. 379. – Jordan et Snyder, 1901, Check list, p. 122.



Text-fig. 126. ***Kareius bicoloratus*** (Basilewsky).

The original description* is as follows:

Platessa bicoloratus

Chinensibus nominatur IIIu цзянв-юц

Corpus laevissimum oblongo-ovale nudum; supra fuscum, linea laterali media designatum, a capite usque ad corporis dimidium serie longitudinali ossea sex-tuberculosa sub dorso praeditum; Subttus album, linea laterali obliqua, antice superiore, postrorsum vero inclinata. Caput acuminatum, nudum, parvum, oculis magris, in dextro la teresitis. Os angustum, supra hians, labis uperiore mobili protractili, dentibus maxillarsibus perulis, setaceis, numerosissimis. Pinnae strictae,-dorsalis et ana lis in me-

*Basilewsky, 1855, Nom. Mem. Soc. Mosco, x, pp. 260–261.

dio dilatatae; prima ab oculis proveniens, secunda post abdominales orta, utraque ad caudam propagata; pectorales ot abdominales parvae; caudalis spatulata ab anali et dorsali intervalle aequali disjuncta.

Habitat in Mari provinciam Shan-dun' ensem alluente. Longitudo secundum lineam rectam ac opice capitis ad caudae apicem 6 1/4 poll.

Latitudo maxima 4 poll.

Description: Head 3.5 inches in length to base of caudal; depth 2.5. Eye, 5.5 in head; maxillary, 4; snout, 5; dorsal, 69; anal 50.

Body rather slender, the upper, anterior outline concave opposite front of eye. Head moderately large, the profile steep, concave above eye, again convex toward anterior tip: the snout somewhat produced, but without an abrupt sharp notch. Upper eye slightly more posterior than lower. Interorbital space convex, rather narrow, and not elevated; its entire width two-thirds of diameter of pupil, bone only one-third. Mouth arched; maxillary reaching to below anterior edge of pupil of lower eye; anterior nostril with a short tube; the posterior with a slightly elevated edge. Teeth compressed and set in a single, even, row on both sides of jaws; the row on eyed side not so long as that on blind side; preopercle not concealed in the skin. Gill rakers of lst gill arch 3 + 5, short and pointed; 4 or 5 on lower limb of arch; pseudobranchiae present. Origin of dorsal above anterior edge of upper eye or slightly posterior to edge. Pectoral of eyed side usually somewhat pointed at ends of upper rays; its length contained 1.5 in head. Pectoral of blind side rounded, its length 2.4 in head. Ventrals reaching to front of anal, that of blind side slightly the more anterior. Caudal truncate or very slightly convex.

Skin naked; about four large rough plates between lateral line and outline of back, following the contour of the latter and running back to a little past middle of entire length. A shorter row of smaller plates, which are not in a continuous rows, but irregularly separated, is on lower part of side; its length considerably shorter than that of head. A row of narrow plates follows lateral line immediately above and below; the rows not at all continuous, but separated at irregular intervals, and when separated the interval is filled by a dermal channel. One or two plates on base of pectoral and often one or two a short distence below and behind base. A few plates on each edge of caudal peduncle. Plates irregularly scattered over opercle and preopercle, an area just behind eyes, and sometimes on interorbital space, covered by thin skin, and apparently the roughened bones of the cranium. The skin otherwise smooth and naked. Lateral line straight, running nearer back than belly, beginning at base of the 5 th ray of dorsal and running obliquely downward and backward to above gill opening and extending along middle of caudal to near tip where it ends abruptly.

Color uniform, brown or drab, often irregularly flecked with dark spots on the fins and body. Usually a row of round white spots, set at rather wide intervals, follows the dorsal and ventral outlines of the body at a short distanse from the base of the fins, and often other light spots are scattered irregularly over the body. All fins on eyed side dark dusky; blind side white.

Type locality: Shantung.

Distribution: Yokohama (JORDAN & SNYDER); Hakodate (SCHMIDT); Japan (OTAKI); Tôkyô; Hakodate; Yokohama; (JORDAN & SNYDER); Tôkyô; Otaru; Hakodate; Same; Matsushima; Muroran (JORDAN & STARKS); Tôkyô market; Sagami Bay, Shizuoka Prefecture (TANAKA); Hakodate; Yokohama (JORDAN & SNYDER).

Order Synbranchoidea

Characters: Body anguilliform. Scales absent or minute, longitudinally arranged. Lateral line present. Skull long, the supraoccipital separated from the frontals by the parietals, which are meeting. Mouth not protractile, bordered above mainly by the intermaxillaries; the maxillaries lying behind and paralled to them. Opercular bones normal. Anterior vertebrae not modifieds, no weberian ossicles. Pectorals absent, only the membrane bones of their arch ars developed. Ventrals absent. only in *Alabes* CUV. present as juglar rudiments. Dorsal and anal rayless bolds of the skin, united with the small caudal, which has a few rays. Teeth in bands or in series on jaws and generally on palatines and pterygoids. Gill membranes confluent, free from isthmus or united with it and accordingly forming a single aperture pierced under the throat and common to both sides or this aperture is only superficially a single one.

Family Flutidae

Characters: Body elongate, naked, barbels none. Margin of upper jaw formed by intermaxillaries only, the well-developed maxillaries lying behind and paralled to them. Paired fins none. Vertical fins rudimentary, reduced to more or less distinct cutaneous folds. Vent situated at a great distance behind the head. Ribs present. Gill-openings confluent into one slit situated on the ventral surface. Air-bladder none. None pyloric coeca. Freshwaters and coasts of Tropical America and Asia. Coasts of Western Australial and Van Diemen's Land. Indo Australian Archipelago, Philippines, tropical parts of West Africa and Central and South America.

Genus Fluta BLOCH et SCHNEIDER, 1801.

Fluta BLOCH et SCHNEIDER, 1801, Syst. Ichthyologiae, p. 525.
Monopterus BERG, 1947, Class. Fish. Rec. & Foss., p. 472, 307.

Type .... **Monopterus javanensis** LACÉPÉDE

Characters: Body more or less cylindrical posteriorly compressed, naked, tail compressed, tapering to a slender point, much shorter than trunk. Only fins a low keel, above and below, on the tail. Lower jaw slightly included; eye small, beneath the skin, placed over the mouth. Slender, scaleless, almost finless eels of southern Asia and the East Indies. Gill openings narrow, joined on the under surface of head to form single cleft. Posterior nostrils an oval opening above anterior part of eye, anterior nostrils smaller opening near end of snout in upper lip. Dorsal and anal fins low, rayless folds

of the skin, confluent with small caudal, which has a few rays. Pectorals and ventrals absent. Teeth small, in bands on inner maxillaries, palatines, pterygoids and mandibles.

129. Fluta alba (ZUIEW).

"Taunagi"

(Text-fig. 127)

Muraena alba ZUIEW, 1793, Nova Acta Acad. Sci. Petropolitanae, VII, p. 299, pl. VII, fig. 2.

Monopterus javanensis LACÉPÈDE, 1798, Hist. Nat. Poissons II, p. 139. – BLEEKER, 1853, Verh. Batav. Gen. XXV, p. 59. – BLEEKER, 1864, Atl. Ichth. IV, p. 118. – GÜNTHER, 1870, Cat. Brit. Mus., VIII, p. 14. – DAY, 1878–1888, Fishes of India, p. 656.

Unibranchapertura laevis LACÉPÈDE, 1803, Hist. Nat. Poissons, V, p. 657, 659.



Text-fig. 127. ***Fluta alba*** (ZUIEW).

Monopterus javanicus SHAW, 1804, General Zoology, Pisces, IV, p. 33. – BLEEKER, 1850, Verh. Batav. Gen. XXIII, p. 22. – CANTOR, 1850, Journ. Asiat. Soc. Bengal, XVIII, p. 1321. – KAUP, 1856, Cat. Apod. fish, p. 123.

Monopterus laevis RICHARDSON, 1844, Voy. Sulphur. èchth., p. 116, – RICHARDSON, 1846, Rep. 15th Meeting. Brit. Ass. London, p. 315.

Monopterus cinereus RICHADRSON, 1844, Voy. Sulphur. Ichth., p. 117. – RICHADRSON, 1846, Rep. 15th Meeting Brit. Ass. London, p. 315.

Monopterus marmoratus RICHADRSON, 1846, Rept. 15th Meeting Brit. Ass. London.

Monopterus albus JORDAN et SNYDER, 1901, Proc. U. S. Nat. Mus., XXIII, p. 836. – WEBER et BEAUFORT, 1916, Fish. Indo-Aust. Arch., III, pp. 413–414, figs. 210–211. – JORDAN et RICHARDSON 1909, Mem. Carn. Mus., vol. 4, no. 4, p. 171. – JORDAN et METZ, 1913, Mem. Carn. Mus., vol. 6, no. 1, p. 24. – TANAKA, 1935, Fig. Desc. Fish. Japan, pp. 455–457, pl. LXXVII, fig. 357.

Cryptophthalmus robustus FRANZ, 1910, Abh. Bayer. Akad. München 4, Suppl. Bd. p. 15.

Fluta alba, GÜNTHER, 1870, Cat. Fish Brit. Mus., vol. 8, pp. 14–15. – TANAKA, 1921, Nihon Gyogaku, p. 200. – CHU, 1931. Biol. St. John's Univ. no. 1, pp. 20–21. – NICHOLS, 1943, Freshwat. Fish. Chi-

na, p. 27. – MIYADI, 1935, Kyoto-fuka no Tansuigyo, p. 35. – SMITH, 1945, Bull. 188, U. S. Nat. Mus., pp. 69-71.

The original description* is as follows:

Muraena alba 1

Corpore serpentiform, zlaberrimo, nudo, albo; cauda compresso-suspipata, limbocutaneo marzinata, Tab. VII, fig.

Dimmensiones

Longitudo fortrius corporis ab apice rostri ped. poll. lin.

	ped.	poll.	lim.
ad extremum caudae	1	5	9
ab apice rostri ad medium oculun	—	—	4
ad nares	—	—	4
ad angulos oris	—	—	7
maxillae superiois ad muhem	—	1	3
inferioris ad arzulo oris	—	—	6
ad apertur branch	—	1	6
Altitudo rictus diductis mandibulia	—	—	5
Distantia inter oculos	—	—	3½
inter nares	—	—	1½
Latitudo maxillae superibris ad oculoe	—	—	6
Altitude rostri ad ocules maxillis	—	—	3½
Latitudo capitis maxima	—	—	8
Altitudo ciusdem summa 2	—	—	7
Circumferentiacapitis ad nuchm 2	—	2	—
Latitudo maxillae inferioris ad oculos	—	—	4
ad angulos oris	—	—	6
Ab apice maxillae inferioris ad anum	1	1	3
Ab ano ad extimum apicem caudae	—	5	8
Ab apice rostri ad exordium pinnae dors	—	11	3
Altitudo caudae infra anum	—	—	7
Crassities in codem loco	—	—	5
Circumferentia trunci oblique aequalis	—	2	1
Apertua ani per longitudinem et transversin	—	—	2½
Apertura branchialis	—	—	2

Description

Corpus eylindricum, number, cute alba glaberrima tectum, extremitate altesa ouato-depressa, altera compresso-lanceolata Caput onato-oblongun, a summo vertice ad rostrum descendens, infra plamun, crassitie reliquo-corpori aequale. Rictus oris transversus, mediocris. Rostrum breue, declive, obtussinsadum maxillis subplagio-plateis, labiatis, inaequalibus, superiose longiore; labiis, superiore, sursum, inferiore quasi duplicato deorsumreflens, carnosis, crassiusculis, intus ordine papillarum cutanedrum cendentibus circumdatis. Dentes in utraque maxilla et palato plurium ordinum, minimi, acerosi, aequales, in plate plusium ordinum, minimi, ocerosi, aequales, in pllato obtusiores, fix, Lingua integra. Carnosa, obtusinscula, libera, glabra, plato vazinata; palatum forincatum, in medioglobrum, lateribus maxilleie, pesallelis denatis, denticulatis. Nares supra oculos dentictae, caales, sursum patentes, solitariae, parmae. Oculi in anteriore capitis parte suie ad bacin rostri sub neribus siti, mediocres, connexiusculi, nigri subrotundi, orbita ouali, cute communi texti, pupilla argentae minima nictantes. Apertura branchialis vnica, subgula in forman ferriegui in formata, membrana branchialis par integrem gulam expansa fere operta. Gula plana. Thorax, Dorsum laterna, abdomen teretia. Linea lateralis recta, and caput elevation, caetrum per totum corpus media, laeniesima. Anus subcauda, a capite remotissiinus, semilunaris, amplus sapatulins. Cauda cathetoplatea, cuspidata, apter-

ygia, imbo versud extremum dorsi inchvane ad apicem caudae Bit cuidentior, in apice vero cum subcaudali confluendo fere caunescit. Pinna subcaudalia longe abano incipet pariter cutanea, magri visibilis caudit ad extremitatem caudae, longe, teren minor altitume, quam dorsali Ambo specimine prostant in collectione DHALBERGLIANA.

Table 128. Measurements of *Fluta alba* (ZUIEW).

Collection	O.H.B.S.*	Collection	O.H.B.S.*
Total length	694. 0mm.	Head/Snout	5. 18mm.
Body length	694. 0	Head/Upper jaw	1. 87
Body length/Head	12. 97	Head/Interorbital width	7. 65
Body length/Depth	23. 35	Head/Diameter of Eye	13. 37
Body length/Preanal length	1. 31		
Locality	China		

*Otsu Hydrobiological Station attached to Kyôto University.

Description: Height 17–26; head 10–13; 7 $^1/_2$ or more in trunk. Tail 2 $^1/_2$ to nearly three times in head and trunk. Eye about 13 in large, about 2.5 in length of snout, situated above middle of maxillary. Cleft of mouth 2.4 to 2.7 in length of head.

Body very elongate, naked, compressed; head moderately large, the profile anteriorly convex, slightly concave over eye, a little elevated on occipital part, deeper than the rest of body, its depth 1 $^2/_3$ in the length of same. Body decreases gradually in depth from nape backward, passing to a much compressed short tail, which abruptly decreases in depth and thickness, and tapers to a point. Lower jaw slightly the shorter; lips thick; maxillary extending far beyond eye; teeth in jaws and on palatines small, pointed, in a narrow hand; tongue rather broad, smooth, largely free anteriorly and on sides; gill openings confluent into ventral slit. Origin of dorsal somewhat behind vent; indistinct anal inserted far behind half way between vent and tip of caudal. Upper surface of preserved specimens brownish or greyish above, yellowish or whitish below. The species is very variable in ground color and markings by individuals and by different localities.

Distribution: This is widely distributed in Asiatic districts from Burma, East Indies, North China, South Manchuria and Korea. This is also found in Formosa (OSHIMA); Okinawa; Amamioshima (JORDAN & SNYDER); Tokyô; Kyôto (JORDAN & HUBBS, TANAKA). It is said that the specimen recorded as from Tôkyô had escaped from the pond of Goldfish dealer, at Shitaya-ku, Iriya-chô, Tôkyô, on June of 1907. China (CHU); Thailand (SMITH); Korea (JORDAN & METZ); Hôkotô (JORDAN & RICHARDSON); Japan (GUNTHER); Tôkyô; Izu-ôshima (TANAKA).

It is said that the northern limit Saitama Prefecture in Honshû, channel of Nizyô Rikyû, Kyôto (MIYADI), River Katsura (TANAKA).

Habits: The present species likes to live in the mud of steady water of paddy fields and very inactive and slow in movement. It has an intestinal respiration as mud loach and can endure dryness for a while.

Remarks: WEBER and BEAUFORT described the habitat of the species as follows, "all over Sumatra, Borneo, Java in freshwater of rivers, brooks, rice ditches, ponds, lakes. We have also specimens from heights of 3000 feet; Lombok; Sumbawa; Banka; Bintang; Natuna Islands; Celebes; Wahai. – Asiatic continent from Malacca, Burma and Siam to Northern China; Chinese Islandes; Formosa and Japan. This fish is capable of living a considerable time out of water and burying itself in the mud when the water is drying up".

SMITH has mentioned the life cyicle of the fish found in every where of Thailand, as follows:

"The best observations on the eggs and young of *Fluta* have been made in Thailand by Luang Anantomasya Pithaks, of the Siamese Bureau of Fisheries. The Fish abounds in Bung Borapet, the large lake, originally a swamp, which has been set aside as a fish preserve and nursery and has been the scene of many studies and experiments on the local fishes. It has long been known to the fishermen of the Bung Borapet region that this eel spawns in the lake, the spawning period extending from July onward. The eggs are laid in shallow water near a bank and are contained in a bubble nest such as is made by various anabantid fishes, but whether both parents take part in blowing the bubbles has not been determined, although the fishermen believe that only the females performs this function. The rafts of eggs are not held in place by aquatic vegetation but float breely in the open water, and the color of the bubble mass undergoes change from time to tim during the progress of incubation. On July 12, 1931, the observer named discovered a school of young swamp eels at the surface in shallow water, and nearly, projecting from a hole in the soft bottom, he saw the head of an adult eel, supposed to be the female parent. The young, numbering several hundred, were in a compact mass 20 to 25 cm. wide, and when some of them were scooped up in a coconut shell the abult made no attempt to defend them but withdrew into the hole. The young were of a pale brownish color, with the upper part of the body and head thickly beset with minute dark brown spots. A dark line extended from the eye to the snout, and a dark stripe extended downward and backward from the eye. The average length of 29 specimens was 33.6 mm., the range being from 27 to 36.5 mm. This eel is caught in considerable quantities for domestic consumption and local sale, and at times shipments are made to the Bankok markets. It bears transportation well, as it is able to live out of water for a long time of its skin is kept moit.

2. Introducing Species

Classified List of the introducing Freshwater Fishes into Japan.

Order Isospondyli

Family Salmonidae

1. *Salmo fario* (Linn.). Brown Trout:– Australia, India, Japan.
2. *Salmo irideus* Gibbons. Rainbow Trout, Steel head:– Australia; India, Ceylon, Japan.
3. *Salvelinus fontinalis* (Mitchill). Brook Trout:– United States America.

Order Eventognathi

Family Cyprinidae

4. *Cyprinus carpio* Linnaeus. Carp:– Asia.
5. *Carassius auratus* Linnaeus. Crucian carp:– China, Malaya, Japan.
6. *Ctenopharyngodon idellus* (C. et V.). Grass Carp: - Ceylon, Thailand, Sumatra, Formosa.
7. *Hypophthalmichthys molitrix* (C. et V.). Silver Carp:– Ceylon, China, Malaya, Thailand, Japan.
8. *Hypophthalmichthys nobilis* (Richardson). Big Head:– Ceylon, China, Malaya, Thailand, Japan.
9. *Mylopharyngodon piceus* (Richardson).

Family Poecilidae

10. *Gambusia affinis* (Baird et Girard). Top-minnow:– Southern Asia.

Family Macropodidae

11. *Macropodes chinensis* (Bloch). Fighting fish:– China, Korea.
12. *Macropodes opercularis* (Linnaeus).– Formosa, Southern China.

Order Labrinthici

Family Oplicephalidae

13. *Ophicephalus argus* (Cantor). – Indonesia, Malaya.
14. *Ophicephalus maculata* (Lacepede):– China, Korea.

Order Percomorphi

Family Percidae

15. *Micropterus salmoides* (Lacepede).– Unit. Stat. America.

1. **Salmo fario** LNNAEUS.

Brown trout

The brown trout is a cold water fish distributed in the colder and temperate portions of the Northern Hemisphere, descending into Asia as far south as the Hindu Kush. It has been introduced into the Indo-Pacific Region in India and Australia. The brown trout can be distinguished from the Rainbow trout by its large scales, heavy spotting and generally both dark and red spots on the sides. The body is rather short and stout, its greatest depth being contained about 4 times in its standard length. The length of head is about $^{1}/_{4}$ of the standard length. The dorsal fin is inserted nearer to the tip of the snout than to the roof of the tail. The pelvic fin is below the posterior part of the dorsal. On the head, body, and dorsal fin usually there are numerous red and black spots, the latter being circular or x-shaped, some of them having a pale border. A yellowish margin is usually present on the front of the dorsal and anal fins and the outer part of the pelvic. The dark spots are few in number below the lateral line. The ground colour of the body is brownish black, varying with food and locality.

2. **Salmo irideus** GIBBONS.

Rainbow Trout, Steelhead, "Nijimasu"

(Text-fig. 128)

Salmo irideus GIBBONS, Proc. Cal. Ac. Nat. Sci., 1855, 36. – JORDAN et EVERMANN, Fishes North America, pp. 500–510, 1896. – AOYAGI, 1957. Gen. Note Fresh. Fish. Japan. Archi p., pp. 40–41, fig. 32.
Salmo rivularis, AYRES, Proc. Cal. Ac. Nat. Sci., 1855, 43.

The original description* is as follows:

Head 4; depth $3^{4}/_{5}$; eye 5. D. 11; A. 10; scales 21–135–20, varying considerably. Body comparatively short and deep, compressed, much more elongate in males than in females. Head short, convex, obtusely ridged above. Mouth smaller than in other species, the rather broad maxillary scarcely reaching beyond eye, except in old males. Eye larger than in other species. Vomerine teeth in two irregular series. Dorsal fin moderate; caudal fin distinctly, though not strongly forked. Color bluish above, the sides silvery; usually everywhere above profusely but irregularly spotted; the spots extending on the sides and on the vertical fins; spots on caudal small; belly nearly plain; sea-run specimens nearly plain silvery; with red lateral band and blotches. Weight $^{1}/_{2}$ to 6 pounds. Mountain streams of the Pacific coast; the typical form found in the brooks of the coast range in California, from the Kalamath River to the San Louis Ray. Abundant and variable, probably entering the sea, and perhaps growing larger there, becoming a "Salmon Trout".

Description: Head 4.5 in length; depth 4.3; eye 4.75 in head; snout 4.75; maxillary 1.9; scales about 120.

Body compressed; caudal peduncle deep; head rather short; maxillary extending

*GIBBONS, 1855, Proc. Cal. Ac. Nat. Sci., p. 36.

scarcely beyond eye; teeth fairly strong on maxillary, premaxillaries, palatines, vomer, mandible, and tongue, those on vomer in two rows.

Body rather profusely covered with small black spots most numerous above lateral line; top and upper part of side of head with few small round black spots; dorsal and caudal with black spots; anal dusky, unspotted; pectorals and ventrals immaculate; side with a red stripe in life.



Text-fig. 128. ***Salmo irideus*** GIBBONS.

Color in alcohol; entire body closely covered with very distinct small black spots, quite as numerous below lateral line as above; head with relatively few roundish black spots, about 20 or 25 on cheek and opercle; fins all black spotted, the spots less numerous on pectorals and ventrals; ventrals, anal, and dorsal tipped with yellowish; mid-

Table 133. Measuremetns of *Salmo irideus* GIBBONS.

Collection	O. H. B. S.	
Total length	310.0mm.	446.0mm.
Body length	270.0	384.0
Body length/Head	4.09	3.87
Body length/Depth	3.80	4.37
Body length/Predorsal length	2.03	2.02
Body length/Prepectoral length	4.76	4.37
Body length/Preventral length	2.06	3.56
Body length/Preanal length	1.39	1.32
Head/Snout	1.42	1.54
Head/Upper jaw	1.74	1.87
Head/Interorbital width	3.07	3.01
Head/Diameter of Eye	6.00	5.51
Head/Length of Caudal peduncle	1.53	1.55
Head/Depth of Caudal peduncle	2.40	2.51
Head/Length of Dorsal fin	1.67	2.01
Head/Length of Anal fin	1.97	2.20
Head/Height of Dorsal fin	1.74	1.91
Head/Height of Anal fin	2.00	1.84
Head/Pectoral length	1.63	1.87
Head/Ventral length	1.94	2.06
Date	IX, 1926	
Locality	Lake Biwa, Shiga Prefecture	

dle of side and cheek with a broad rosy band; no red on throat; scales 134.

On account of the scientific data, the author added the following notes and descriptions for reference.

Remarks: According to JORDAN, the typical rainbow trout (*Salmo irideus*) is found only in the small brooks of the coast ranges in California, from the River Klamath to the San Louis Ray in San Diego Country. It is subject to large local variations, some of these landlocked in peculiar brooks, as in Purissima Creek in San Mateo Country where the individuals are small and brightly coloured, and popularly regarded as a distinct species. JORDAN and HUBBS* described *Salmo shasta* JORDAN (called Shasta Rainbow-trout) from the specimen of Lake Biwa which was presented by Prof. CH. ISHIKAWA. They mentioned that the species was introduced from the hatchery at Baird on the McCloud River near Mount Shasta, California. This may be common American Rainbow trout cultured in Japan and included under the name of *Salmo gairdneri irideus* (GIBBONS).

JORDAN also described the present species reaches a weight of half pound to 5 or 6 pounds, though in most of the streams in which it is found it rarely exceeds 2 or 3 pounds.

Since 1877, we have transplanted this Rainbow trout into Lake, Nikkô, Chuzenji Japan from California, U. S. America. As the fish have the strong resistance for high water temperature and very easy for the artificial fertilization and the breedings, they are culturing in wide area of Japan. In Japan, they breed on December to March and feed on aquatic insects. We always feed them by pupa of silkworms, *Orchestia* and *Acellus*.

Eggs are yellow or orange, red, measuring 5.0–5.7 mm. in diameter. After the fertilization, the youngs hatch out 90 days under the water temperature 5.0°C., 80 days under 8.0°C. and 25 days under 13.0°C. The just hatching out larva measured 15 mm. in total length.

The rainbow trout is a rather common introducing trout in temperate region, native in Californian waters. It has been introduced into mountain regions resembling those of temperate regions exist. In the Indo-Pacific region it is now to be found in Ceylon, Japan and Australia.

When the eggs of Rainbow trout were carried to Japan, the eggs of the present species were said to import. It has nearly same habits of landrocked trout. It feeds on insects, fishes and other small animals. In Japan it has found in Okutama, Tôkyô district; Shiobara, Tochigi Prefecture and River Kurobe, Toyama Prefecture.

The rainbow trout has a comparatively short and deep body, which is more elongate in males than in females. The depth of its body is contained about 3–4/5 times in the body length. The short head is about $^{1}/_{4}$ the total length and is obtusely ridged above. The mouth is moderately small and the maxillary nearly reachs beyond the eye, which is rather large and is contained five times in the side of the head. Dorsal fin has 11 rays and anal fin has 10 rays. Scales 135 in the lateral line varying from 120 to 180, ar-

* JORDAN et HUBBS, 1925, Mem. Carneg. Mus., vol. 10, no. 2, p. 139.

ranged 20 rows above and 20 rows below the lateral line. The colour very variable, depending on sex, age and environment. Typical specimen is bluish above, silvery on the sides, irregularly spotted with dark on the back and side, extending to the vertical fins. Red lateral band and blotches on the middle of body and nearly plain colour on the belly. Although in tropical and subtropical countries this trout can live in streams and lakes as well as ponds of mountain regions, this is generally found in ponds and lakes located in the plains of temperate and subtemperate countries. A water temperature ranging from (38°F., 8°C.) in winter to (70°F., 20°C.) in summer. A maximum temperature of 18°C. is the most suitable one for this fish. In natural, it prefers clear running streams but in culture it tames somewhat weak current in pond. In tropical regions it is often necessary to supplement natural spawning in the streams by artificial propagation in hatcheries and nurseries. This fish is mainly an insectivorous fish. It feeds mainly on stream insects, Dipteran larvae, beetles, worms, crabs, prawns, shrimps, snails and small fishes. In Japan, the breeding season is continued from November to next April or May.

Breeding is carried out in streams and lakes during the winter. At that season, the fishes move up the streams to lay eggs in the sand or gravel of the water bottom. The fertilized eggs are covered by sand until they hatch out. Under temperatures less than 25°F., the embryos hatch out of the eggs by the 29th day. In a couple of months they grow into fry of 2.5 cm. to 3.8 in size.

The growth of the Rainbow trout depends largely on the temperature of the waters and on the amounts of food supply. Under favourable conditions, in one year's time it can attain 20.3 cm. to 25.4 cm. in length. Growth up to 30.5 cm. to 35.6 cm. in the second year, and 40.6 cm. to 45.7 cm. in the third year has been observed. In lakes and streams, their growth rate may average about 5.1 cm. less per year. They grow until they are 8 or 10 years old, the rate of growth, deminishing with age.

T. Higurashi has made an experiment on the growth of Rainbow trout in Suga-numa, Maru-numa and Oshiri-numa, located in Higashi-ogawa, Katahina-mura, Tone-gun, Gunma Prefecture during 1912–1917. He has transplanted Rainbow trouts which were introduced from U. S. America in 1913. 69671 youngs were discharged in the above mentioned three lakes. He has observed the growth rate during three years.

	Length (average)	Weight (average)
One year after discharging	20.7 cm.	112.5 grm.
Two years 〃 〃	30.3 cm.	386.25 grm.
Three years 〃 〃	33.0 cm.	408.75 grm.

On May of 1913, the rainbow trout was introduced from Beard Hatchery, California, U. S. America. into Japan. Ten thousands eggs were transported to Aisaka Hatchery in Aomori Prefecture. During 1917–1919, the authority transported twenty thousands eggs to Zyûniko fish pond at Iwasaki-Mura Nishi-tsugaru Gun, Aomori Prefecture and discharged youngs into a river. On 13th of May, 1912, the Shiga Fisheries Experiment

Station imported 40 thousands eggs of Rainbow trout from U. S. America when they arrived at Kôbe harbour, then carried into Komatsu Fish Farm. It is said, that they hatched out on 18th 23rd of May and grow into 37574 youngs. 17514 youngs were discharged near Okinoshima, Lake Biwa and 17600 youngs carried to the Komatsu Fish Farm. The rainbow trout was introduced from U. S. America into Japan in 1877. The eggs were taken from the adult trouts found in the river running along the foot of Mt. Shask, California, United States of America. It was ten years earlier than exporting to Europe from America. T. KOSHIDA has reported that he has transplanted them into Inawashiro Lake in Fukushima Prefecture from Shiroko fish pond at Kitaadachi-gun, Saitama Prefecture in 1880. They are mostly found in southeastern part of the lake and come up to River Funazu or River Hara to lay their eggs during the end of September to October. They grow into about 36 cm. in size.

In 1913, the Miyazaki Fisheries Experiment Station transported 38577 young trouts into Ôita, Takahara-mura, Nishimorogata-gun, Miyazaki Prefecture on the end of June of 1913. On the April of 1914, the authorities bought 5 thousand eggs at Nikko fish farm and discharged 3629 youngs from these eggs into fish pond to culture. On April of 1915, he has also imported 20 thousand eggs from U. S. America, from these eggs he has obtained 16208 youngs. After three weeks, they grow into 2 cm. in size. 8984 youngs were discharged into Oike and 5000 into culture pond.

It was a first experience to make the artificial fertilization of eggs in 1910, in Fukushima Fisheries Experiment Station, Fukushima Prefecture. In 1913, the station also bought the Rainbow trout at U. S. America and transplanted them into Tsuchiyu and Numasawanuma. It was a quite successiful in latter water and able to make the artificial fertilization in 1919. After that time, in 1920, he also transplanted them in Kawageta Hatchery near Mt. Asama of Fukushima Prefecture as well as in Lake Inawashiro.

K. ISHIKAWA, one of the authorities of the Fukushima Fisheries Experiment Station reported his experiments on the transplantation of the rainbow trout in Numasawanuma in Fukushima Prefecture. He has supported this experimental water may be most profitable for the breeding of the rainbow trout. He has transported 4 thousand eggs and discharged in 1913 and 1915.

During 1926 and 1928, about 20 million eggs are obtained in this water.

In Akita Prefecture, the Fisheries Experiment Station has imported 50 thousands eggs into Yatsuyagi fish pond. After hatching out 35 youngs were discharged into culture pond called "Soramoto Numa" and the remainings 2 thousand youngs into the culture pond. They could endure up to high water temperature 25° and spawn in the ponds in May of 1916 at the first time after 3 years of hatching out. They laid eggs till 1919 and some of them discharged into Lake Towada in 1918, they are still caught at there.

The Chitose Hatchery, one of the largest salmon and trout hatchery belong to Hokkaidô Fisheries Experiment Station, has brought the eggs of Rainbow trout from the hatchery of Nikko Lake Chûzenji, one of the branch of Imperial Forest Bureau. On February of 1920, he could obtained the 50 million eggs annually. M. KAWAJIRI made

the experiment on the optimum temperature of hatching of Rainbow trout in Kizaki Fish Culture Experiment Station at Nagano Prefecture, in 1926. He found the optimum temperatures are arranged from 6° to 9° and noticed the most of abnormal embryo occurring in the minimum temperature 6°. So he remarked that the optimum temperature may exist in 9°.

As a result, the rainbow trout culture have been extended to a wide range of the country with liberation in the natural waters as well as rearing in ponds fed with spring water. The enterprise became so prosperous in recent few years that large quantities of the adults are processed into frozen forms and exported to the United States of America.

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3. **Salvelinus fontinalis** (Mitchill).

Brook trout, Speckled trout, "Kawamasu"

Salmo fontinalis, Mitchill, 1815, Trans. Lit. and Phil. Soc. N. Y., I, 435.
Salmo alleghaniensis Rafinesque, 1820, Ich. Oh., 44.
Salmo nigrescens, Rafinesque, 1820. Ich. Oh., 45. - Gunther, 1866. Cat., vi, 152.
Salmo canadensis, Hamilton, Smith in Griffith's Cuvier, x, 474, 1834.
Salmo hodii Richardson, 1835. Ross. Voyage, App. lviii, - Fauna Bor. - 1836, Amer., iii, 172.
Salmo immaculatus, H. R. Storer, 1850, Bost. Journ. Nat. Hist., vi, 364.
Salmo hudsonicus, Suckley, 1861, Ann. Lyc. Nat. Hist. N. Y., 310. - Gunther, Cat., vi, 153, 1866.
Salvelinus fontinalis, Jordan, 1878, Proc. U. S. Nat. Mus., 81. - Jordan et Evermann, 1896, Fishes of North America, pp. 506–507.

The original description is as follows:

Common trout

Salmo fontinalis; With yellow and red spots on both sides of the lateral line, concave tail, and sides of the belly orange red.

Back mottled pole and brown. Sides dark brown, with yellow and red spots; the yellow larger than the red, and surrounding them. The latter appear like scarlet dots. Lateral line straight. The yellow spots and red dots both above and below that line. Sides of the belly orange red. Lowest part of its abdomen whitish with a smutly tinge. First rays of the pectoral, ventral, and anal fins white, the second black, the rest purplish red. Dorsal fins mottled of yellowish and black.

Tail rather concave, but not amounting to a fork; and of a reddish purple, blackish spots above and below.

Eyes large and pale. Mouth wide. Teeth sharp. Tongue distinct. Skin scaleless.

Is reckoned a most dainty fish. They travel away to Hemptead and Islip, for the pleasure of catching and eating him. He is bought at the extravagant price of a quarter of a doller for a single fish not more than ten or twelve inches long. He lives in running waters only, and not in stagnant ponds; and therefore, the lively streams, descending north and south from is their sources on Long-Island, exactly suit the constitution of this fish. The heaviest Long-Island trout that I have heard of, weighed four pounds and a half.

Rays, Nr. 10, P. 12, V. 7, D. 13 and O. A. 11, C. 23.

Sept. 6th caught at Nichols'		weighing	lbs. oz.
8	at Patchoque	9	7.8
9	do	21	10.8
10	do	78	26.0
12	do	5	5.0
13	do	4	5.8
15	at Fireplace	1	3.0
16	do	16	16.8
17	do	9	8.0
19	at Patchoque	23	47.0
20	do	6	7.8
21st	do	4	8.3
Days 12		Fish 190	Lbs. 139.11

*Mitchill, 1815, Trans. Lit. & Phil. Sos. N. Y. I., pp. 435-437

I copy the following article from the news-papers: "Mr. Robbins, of the Philadelphia theatre, visited Long-Island (New-York State) in the summer of 1864; during his stay in that place, he caught one hundred and ninety freshwater trout, weighing as follows, viz.

"The largest fish caught at Patchoque, weighed two pounds and eight ounces; and the largest at Fireplace, three pounds. "Dr. Port. of New-York caught one hundred and fifty trout, weighing one hundred and five pounds, in the month of April, 1814, in the waters of Long-Island.

"Mr. Pauvis, of New-York, caught a trout weighing four pounds eight ounces, measuring twenty-four inches in length. A drawing of this fish remains at Fireplace, near where it was caught."

Head 2½; depth 4½; D. 10; A. 9; scales 37–230–30; gill rakers about 6+11. Body oblong, moderately compressed, not much elevated. Head large, but not very long, the snout bluntish, the interorbital space rather broad. Mouth large, the maxillary reaching more or less beyond the eye. Eye large, usually somewhat above the line of the axis of the body. Caudal fin slightly lunate in the adult, forked in the young; adipose fin small; pectoral and ventral fins not especially elongata. Red spots on the sides rather smaller than the pupil; back mostly without spots, more or less barred with darker; lower fins dusky, with a pale, usually orange, band anteriorly, followed by a darker one; belly in the males often more or less red; sea-run individuals are often nearly plain bright silvery. Many local variation distinguished by shades of color, also occur. Length 18 inches or less. (*fontinalis*; living in spring).

Description: Length of head $4\,^1/_2$ to $5\,^2/_3$, of caudal fin $6\,^3/_4$, height of body $4\,^2/_3$ to 5 in the total length. Eyes diameter of each from $4\,^1/_2$ to 5 or $5\,^1/_2$ in the length of head, 1 to $1\,^1/_2$ diameters from the end of the snout, and from 1 to $1\,^3/_4$ apart.

Teeth 4 or 5 across the anterior portion of the vomer where that bone joints the palatine arch but none along its body. In a single row along the palatines and in the jaws.

Dorsal fins commence slightly nearer to the end of the snout than to the base of the caudal fin, its third or fourth ray is the longest and somewhat exceeds the length of the base of the fin. Pectorals extends about half-way to the base of the ventral, which latter is inserted below the centre of the rayed dorsal fin. Caudal forked in the young, but becoming square with age. Scales 40 to 49 rows from the lateral line to the base of the ventral fin; 21 to 26 rows from the hind edge of the base of the adipose fin downwards and forwards to the lateral line; from 185 to 235 rows pass from the back to the lateral line.

Color in alcohol, the body greenish along the back, becoming lighter on the sides and below, the whole being beautifully shot with purple and gold. Numerous round or oval spots along the back becoming fewer below the lateral-line; anteriorly from the head to the dorsal fin many coalesce. Red spots above, on, and some times below the lateral-line. White edges with black bases to the upper margin of the pectoral and the anterior edges of the ventral and anal. Sinous bands of black or rings on the dorsal fin; the upper and lower edges of the caudal barred. During the breeding season, the lower surface of the body of the male is frequently of an intense velvety black.

Remarks: In 1902, the fish was transported from North America into Japan to breed in the streams and rivers. It feeds on aquatic insects and small animals in natural and on *Gammarus*, pupa of silk-worms, *Orchestia* in culture. The breeding season is November and December in Japan. Eggs yellow and red, measured 4–5 mm. in dia-

meter and hatched out 120 days under the water temperature of 4.0°C., and 60 days under 8.0°C, and 50 days under 12.0°C. of water temperatures.

It is said that Brook Trout was introduced in 1909 from United States of America into Japan in the form of eggs.

On 1st of February, 1912, the Bureau of Fisheries of Japan imported 20 thousands eggs of Brook Trout into Japan. They were carried by steamboat from U. S. America to Yokohama harbour and transported to Chinai Hatchery of Shiga Fisheries Station. They hatched out 16-29 of February into 18921 youngs. Then the authorities carried the 2926 youngs to Samegai Fish Farm Pond on 18th of April and the 5216 youngs to the Soya Fujino Fish Farm. They were measured about 2.2 cm. at that time and grow into 14 cm. on 23rd, August of 1912 and 23 cm. on 13, March, 19143, then 34 cm. on November of the same year. They laid 24421 eggs in the breeding season.

In Ishikawa Fisheries Experiment Station, the authorities have bought 1190 thousands eggs from U. S. America into the hatchery and fed 5 cm. lengthened youngs after hatching out. In 1914, they discharged 848000 youngs into River Tetori, River Saigawa, River Daishoji and River Iburihashi.

Akane, K. reported that the Akita Fisheries Experiment Station has imported brook trouts into Akita Prefecture to discharge them into many rivers.

Kasai, Hanjiro also reported, the Shimane Fisheries Experiment Station has tried the trout transplantation into the rivers. In 1919, about 300 thousands eggs of brook trouts were imported and after hatching out, the youngs grow into 6 cm. body length and were discharged into River Takatsu of Shimane Prefecture.

On 11th of January, 1929, the 600 thousands eggs of brook trout were imported from U. S. America into Yokohama harbour by the Tôkyô-to Fisheries Experiment Station. The authorities carried them to Yoshino Fish Farm to hatch. On the end of March, 400 thousands youngs were obtained. They were discharged during 12th of April and 22nd of May into River Tamagawa and a branch River Okigawa.

In young, 7–9 elliptical parr marks on both sides on the body and when it grows into 150 mm. of body length, may have a reddish purple longitudinal band along the median line. The parr marks gradually disappeared. Many black spots distributed on the back of body and on the fins. Vomer flat with teeth, the median of which is arranged one another on both sides or serrated lines. In Japan, they breed in winter (December-March) and feed on insects and other small animals. In hatcheries, nurseries, natural foods such as silk worm pupae, *Orchestia* ("Shiomushi" in Japanese) and *Gammarus* ("Kotomushi" in Japanese). Eggs are yellow, orange, and sometimes red, measured 5.0–5.7 mm. in diameter. After the fertilization, they hatch out 90 days in 5.0°C. water temperature, 50 days in 8·0°C. and 25 days in 13.0°C. water temperature. The just hatching out embryos measuring 15 mm. in total length.

Here the author added the scientific notes and descriptions concerned with the present species.

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4. **Cyprinus carpio** LINNAEUS.

Carp, "Koi"

The common carp has a narrow terminal mouth with smooth simple lips. It has generally 4 barbels but occasionally only one pair will be present. The dorsal fin has 4 spines and 14 to 22 branched fin rays. The anal fin is short and the first simple ray is strongly ossified and serrated.

Habits: The common carp is essentially a river fish and under natural conditionn behaves as any other river fish. It is extremely hardy and is resistant to low oxygen tension and restricted space. It can live out of water for several hours and can consequently stand transport to great distances.

It was originated from the Central Asia and was introduced into China and Japan in Oriental region and into Greece and Europe through Roma, Italy in ancient time. ARISTOTL mentioned carp in Greece and may be introduced in that time and into Southern Europe in Roman period. In northern and western Europe, it was introduced in later. In Austria, it was cultured since 1227 and transplanted into Germany and France. This was also introduced into England in the age of 1600 and into Sweden in 1560 as well as into Denmark in 1660. Into United States America, HENRY ROBINSON introduced the carp from France in 1831 and German people called Pop also transplanted it into California in 1872. In Japan, the carp was described in national history on the first time, at the period of Emperor "KEIKÔ" during the year of 100. He has enjoyed the carp in a pond established in Oyogi-Miya. The Emperors "SUININ and SUIJIN" have made the canals for the water privilege and tried the fish culture. The common carp was used for the pond-culture industrially during the period of "Genwa". It was introduced from Musashi province into Yuishinden, Kanbara-gôri Echigo province and

reared in pond. It is suitable for rearing in paddy fields. In Shinano, Yamato and Uzen provinces, the paddy field rearing method was happened during 18 (nearly the end period of Edo). Nozawa town located in Sakudaira, Shinano province, seems to be a center.

Being a very adaptable and hardy fish, it has now established itself in the temperate regions of Europe, Palestine and America, and in the sub-tropical waters of Malaya, Indo-China, Thailand, Sumatra, Java, Japan and India. As a result of many year of culture, several varieties of the common carp have evolved. In Japan we have also found several local varieties in northern and southern regions.

The carp has been cultured for hundred years with a record of the practice on a commercial scale around 1800.

A requisition for carp culture is to secure supply of the seedlings, and the fry artificially hatched and raised by many nurseries or private farms are used for the purpose.

The culture method may be classified into 3 types.

1). Liberation of the fry in rivers and lakes 2). Raising in ponds
3). Culture in paddy fields

1), Liberation program in rivers and lakes

Carps which have grown up to 2 or 3 inches by autumn after hatching out in April, would be released into natural waters, as rivers, lakes and swamps. The fish under a limited size are protected by laws for fishing.

2). Raising in ponds

The method may be divided into 3 phases.

a). Nursing of seedlings b). Rearing of adult in stagnant waters
c). Rearing of adult in running water pond.

a). Nursing of seedlings

Public carp nurseries are producing the seedlings which are to be distributed for the cultivation in ponds and paddy fields as well as the liberation in rivers and lakes.

In the spawning season during April and May, the sex matured adults are transported into a spawning pond at the ratio of 3 males to one female. The pond has to be furnished with weeds or fibres of hemp-palm to be deposit the eggs. After hatching out the youngs are fed with *Daphnia* or *Moina*. During the second week, they are fed with silk worm pupae, powdered dry shrimps, fish meal, and floor.

b). Rearing in stagnant waters

When the carps are reared for food, streams or spring waters are introduced in a stagnant pond. The carps are fed with flour and silk worm pupae. Many of irrigation reservoirs are also used for this purpose. The total weight of the carp in a pond should be controlled at 500 grms. per square meter.

c). Raising in running water ponds

This possible method is used for rearing many carps in a small area of water. It is one of the good examples to know how the adequate quantities of food in a pond of 40 square meters during the middle of April and the end of November. The maximum production would be carried as high as 200 kgrm. per 'tsubo' (one tsubo approximates 4 square yards).

3). Culture in paddy fields

The special method for carp culture in paddy fields started in 1840. Nagano Prefecture may be given a credit for technical development of the culture as the oldest pioneer in the history, the practice is prevalent in every region where paddy fields are located.

Of two methods, one of which is ordinary carried out by many culturists, is for the first year fish, and the other for the second year fish. For the first year carp, the ridge of the carp pond surrounding the paddy field is built a little higher than usual, with simple opennings furnished for in-take and out-let of water. About a week after rice-planting, in the middle of June, the fry measured about a half to one inch are released in the field at the density of 500 to 600 individuals per 'tan' (one 'tan' equals 0.24 acre). If the farmers want to use a part of the field as a hatching pond, they make the *Daphnia* to grow in the water before the fry are brought at there. The frys are left at there till they swim out to other water of the paddy field. Even in water of the fields the carp are raised without artificial foods. After feeding the fish, they are catched in the middle of October when the water is drained from the field ready for rice harvest. They grow up about 5 inches long at that time, weighting 0.6 ounce each, with the yield of 300 to 400 fishes per 'tan'. The carp collected from the field are usually kept in a nurshing pond or an irrigation reservoir until they grow up to a marketable size.

For the purpose of raising the second year carp, the ridge of the fields must be built higher and more durable than that of the first year fish.

How many carp are to be put in a field and whether or not they need feeding depend on for what the yield is to be used. If we are to raise the same fish again in rice fields next season, 500 individuals, weighing about 0.6 ounce each, have to be released in an area of one 'tan'. Without feeding the fish will grow to some 5 ounces in weight by the harvest time. They are kept in the pond furing winter and put back into the rice field next season. At the end of the season, the fish reach the weight of 13 to 26 ounces each 200 individuals are enough to be put in the same area. The first year carp sometimes can be reared in the paddy field together with the second year fish.

The relationship between the carp cultured in rice fields and the growth of rice is not yet solved scientifically. Recently the scientific researches for the above-mentioned question are carried out and the following may be pointed out as advantages.

1. The fish culture is somewhat beneficial for rice-crop as the carp serve as a sort of insecticide in preying on injurious insects for rice.

2. Farmers would be relieved to some extent, from weeding works in rice fields as the carp feed on the weeds.
3. With excrements from the fish, farmers are able to save some amount of fertilizer.
4. The movement of carp is stimulative for the branching out of rice stalks, so that the yield of rice increases when carp are kept in the paddy field.

The mirror carp, called "Kagamigoi" in Japanese were introduced from Bavarian district in Germany in 1905 into Japan. Four females were transplanted in Tokyô and made the interbreeding between Japanese common carp in 1906. They show rapid growth after hatching out in Japan and make the wide distribution. But most of the Japanese does not like them as the common carp as they have no fine outer configuration, and now the culturists have not tried to keep them in the pond.

The common carp is an omnivorous and prefers food of animals of the group *Chironomidae*, *Ephemeridae*, *Trichoptera*, *Tubificidae*, *Crustacea* and *Mollusca*, vegetable matter and plankton. The vegetable matter makes up a large part of its diet. It obtains the food by routing about the mud like a pig and it thus makes the water turbid. The common carp spawns in ponds streams, ditches, rivers and lakes. In Japan the carp has been observed to breed from April to June. The fertilized eggs are demersal and adhesive. They are spherical in shape and have an average diameter of about 2.1 ∼ 2.6 mm. Under cultivation the carp can breed in large as well as small ponds, in fact in any type of water where there are some plants or objects to which the eggs may adhere. The optimum temperature for hatching out is 20°. Two or three days after fertilization, the eye appears and 6–7 days hatches out. After hatching out, the fry has a yolk sac during 2 or 3 days and does not take foods and after 4 or five days the yolk sac may be absorbed and feeded by a boiled eggs. It may continue about seven days and then feeds on *Daphnia* in a pond. The adult feeds on pupae of silk-worm, dried shrimps (*Mysis*), marine bivalve (*Tapes*), *Limnodrilus*, *Tubifex*, *Vivipara*, wheat flour, Soy sediment, used "Miso", malt, wheat bran, dried sardin, dried herring, visera of bird, fish and beast.

Mostly the pupae of silk-worm is used in many ponds.

The chemical contents of the food are analyzed as follows:

water	protein	fett	ash	non-nitrogen
12. 721	45. 981	27. 454	7. 053	6. 791

The next usual food is small shrimp (*Mysis*). It contains the following chemical elements.

water	protein	fett	ash	non-nitrogen
33. 306	34. 987	6. 973	19. 023	5. 211

5. **Carassius auratus** (Linnaeus).

Crucian Carp, "Funa"

The Crucian carp is also kown in Japan from the olden time but less important than carp. It has a wide range of distribution all over the freshwater areas. It has a rather strong resistance and can be reared in the same way as carp in natural freshwaters, ponds and rice-fields but not so easy as carp.

The Crucian carps have several races in Japanese waters. They are generally distinguished three races: one is called "Hirabuna, Ginbuna" the second "Marubuna" and "Gengorobuna". But Matsui, Y. has distinguished two races of the Japanese Crucian Carps into "Hirabuna" and "Marubuna". "Gengorobuna" is called one of the races of "Hirabuna".

"Hirabuna" is also called as "Ginbuna" or "Mabuna". It has bilaterally flattened body and appears deeply whitish color in fresh.

"Gengorobuna" identified with one of the race of "Hirabuna" grows larger and very weak for the oxygen absence.

It has also strongly bilateral flattened body and very high just behind the head and broad one the opercular region. The caudal peduncle very narrow and the end of both lobes of caudal fin somewhat pointed.

There are very few male in "Hirabuna" and "Marubuna", the sex ratio 100: 3–17 while in "Gengorobuna" the sex ratio is nearly the same.

The Crucian carp is rather strong for cold water and has somewhat more retard growth than carp. It is omnivorous, has a earlier and longer breeding season than the carp. The youngs are liberated and also raised to some extent in irrigation reservoirs; particularly in those located in central Honshû, but not so often in commercial fish farms.

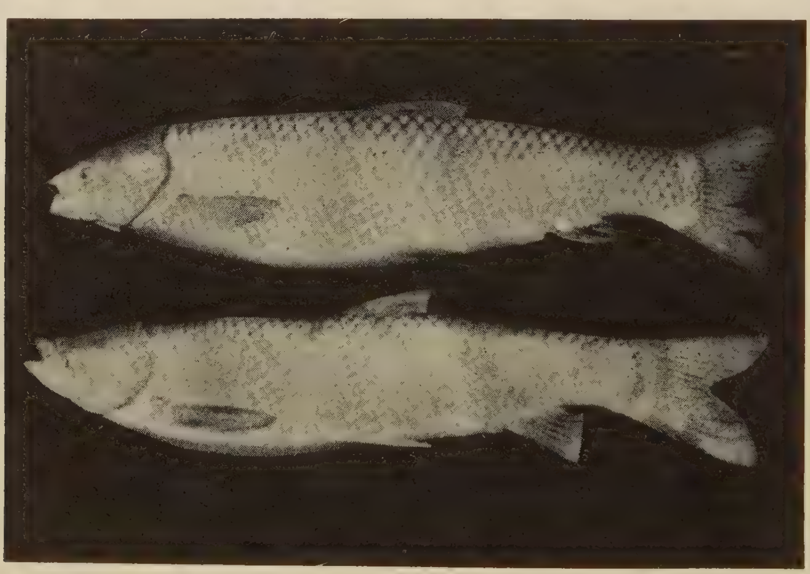
The Crucian carps are also reared in paddy fields together with carp. The methods for collecting the eggs and rearing the fry are nearly same to those of common carp.

"Marubuna" is also called as "Kinbuna" with somewhat rounded body and with brownish golden colour.

The interbreeding between the common carp and Crucian carp has been carried out by Matsui, Y., since 1916. This hybrid is called "Koibuna" in Japan. Furthermore about three races of the common carp, the research on specific improvement through artificial selection has been under way in the hope of greater production of the fish.

6. **Ctenopharyngodon idellus** (Cuvier et Valenciennes). Grass Carp, "Sôgyo, Sôhii" (Text-fig. 129)

The Grass carp is a very important favoured fish for pond culture in Southern Asia. It has been introduced into Malay Peninsula, Sumatra and Formosa. During the war, it has been introduced also into a channel around the palace of Japanese Emperor in Tôkyô. Now it has been discharged in River Tone together with *Hypophthalmichthys molitrix* (C. et V.) and breed at there.* The youngs have brought from River Yangtze, China. It is said that this fish spawns when the Rivers Yang-tze are in flood. The fish attains maturity in the third year. The spawning season may extend from April to the middle of August. A medium-sized female may contain about 100,000 eggs. They are smooth and non-adhesive, and are deposited in the center of the river



Text-fig. 129. ***Ctenopharyngodon idellus*** (C. et V.).

where the current is the strongest. The fertilized eggs hatch out in 32 to 42 hours at a temperature between 78.8° and 86°F. The youngs may characterized as an adult during 15 to 20 days after hatching. Fry hatched in late spring, may reach 30.5 cm. in length and a weight of 680 grammes at the end of the same year. In the second year, it attains a length of at least 60 cm. and a weight of 1.8 to 2.3 kgrms. In four years it may weigh more than 4.5 kgrms.

This fish is a very active and resistant to low oxygen tension and restricted space.

*Nakamura, M., 1949, Shigenkagaku Kenkyûsho lkô, 14, pp. 31-341.

In Japan, this fish could not breed in the fish pond. N. KAWAMOTO* has tried for deposition of eggs by hormone injection but not yet succeeded.

On June of 1877, by the authorities of Agriculture Bureau of Japan ("Kannokyoku, Naimusho"), the youngs were introduced from Shanghai into Nagano, Hyôgo Prefectures and Tôkyô. On November of 1915, the Fisheries Institute of Tôkyô introduced 60 thousands youngs from Formosa into Shiga Prefecture. On December of 1930, 5000 youngs were brought from South China into Shiga Fisheries Experiment Station through Formosa and also on January of 1935, the Fisheries Institute of Shiga Prefecture introduced 20 thousands. On August of 1936, by the Ôomi Fisheries Associations of Shiga Prefecture, 1000 millions of youngs were brought from Seiko, China through Formosa to Shiga Prefecture and transplanted to Hyôgo, Aichi Prefectures and Tôkyô. In 1941, the department of Fisheries of Agriculture Ministry introduced 240 thousands from Kyuko, China into Hyôgo, Nagano, Fukushima and Saga Prefectures. However, they did not seem to propagate in Japanese waters until a few years ago when a small numbers of the youngs were caught in the lower stream of River Tone, proving that the fish could reproduce in Japanese waters, too. M. TANGE reported that the introducing grass carps are found in Kitaura, one of Kasumigaura Lake, Ibaraki Prefecture in 1948. The youngs are caught in Kitaura on September of 1947. They seems to be the offsprings of parents which were introduced during the years of 1943–1945. From the studies of scales done by M. TANGE, they may be breed in the lower regions of River Tone connected to Lake Kasumigaura by canals. M. NAKAMURA also found the youngs in River Watarase, one of the branches of River Tone during 1948. In this connection ecological studies of the fish in the new environments of Japan are under progress. Another research on effects of hormone injection to promote the spawning has not been conclusive yet.

In 1909, the youngs were brought from Formosa on September to the pond of the Fuyuki-chô Laboratory of Fisheries Institute, Fukagawa, Tôkyô and were used for the experiments of growth. The results of experiment were as follows.

Specimens	Measured on 1, IV, 1910		Measured on 1, XXII, 1910	
	Body length.	Body weight.	Body length.	Body weight.
No. 1	12 cm.	59.1 grm.	24.3 cm.	340. grm.
No. 2	9.6 〃	48.1 〃	24.0 〃	333. 〃
No. 3	9.0 〃	54.4 〃	23.4 〃	321.9 〃
No. 4	9.0 〃	54.4 〃	23.4 〃	314.5 〃
No. 5	7.5 〃	22.2 〃	22.5 〃	29.60 〃

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*KAWAMOTO, N., 1950. Gyogaku Zasshii, vol. 1, No. 1.

lus (C. & V.). Gyogaku Zasshi, Vol. 1, No. 1.
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7. **Hypophthalmichthys moritrix** (Cuvier et Valenciennes).

"Hakuren"

This is restricted in its distribution to China in temperate and subtropical regions. It inhabits the rivers and swamps.

The eyes situated somewhat nearer the ventral side of body. The scales minute. The vent-median line somewhat raised, the anterior end somewhat reach to pharyngeal region over the ventral fin. Body somewhat blueish grey white in fresh. The growth somewhat rapid, attains a length of approximately 2 feet or more of *Ctenopharyngodon idellus* (C. et V.). The flesh is very excellent and may be one of the important edible fish in China. It was introduced to Japan together with *Ctenopharyngodon idellus* (C. et V.) and a few youngs are caught in River Tone, furnishing an evidence that propagation of the fish is possible in Japanese nature.

8. **Hypophthalmichthys nobilis** (Richardson).

"Kokuren"

Aristichthys nobilis (Richardson)

This is originated in southern China and has been introduced into Thailand, Singapore, Malayan Archipelago, Java and Formosa for culture in fish ponds. This is one of the most excellent cultured fish is Formosa and also introduced into Japan together with *Ctenophryngodon idellus* and *Hypophthalmichthys moritrix* and some of them were found in River Tone, Chiba Prefecture. The fresh colour is uniform, generally dusky green on the back mottled with irregular patterns and fins and pale in the abdominal region.

Head big, the mouth is oblique with the lower jaw projecting. Snout is somewhat depressed. Pharyngeal teeth are arranged in a single row 4, –4. The abdominal keel is prominent behind the ventrals and scarcely extends to the thorax. The dorsal fin is short with 3 simple and 4 branched rays. Its origin is behind the pelvics and nearer to

the base of caudal than to the tip of the snout. The scales on the body are small and there are 100 scales along the lateral line.

This is resistant to low oxygen and can be cultivated together with other species. The food is consisting mainly of plankton; *Flagellates*, *Diatoms*, *Cyanophyceae*, *Cilliates* and *Rotatorians*. It can also feed on small particles of rice bran and bean meal that float on the surface of water. It grows into large size.

9. **Mylopharyngodon piceus** (Richardson).

Black Carp, "Aouo"

The Black carp is called Green carp "Aouo" in Japanese and native in China. It has been introduced into Malaya, Indo-china, Thailand and Japan. But it is not popular as other introducing fishes.

The general colour is dark brown, much darker than below. The body is moderately compressed posteriorly and the head is slightly depressed. The eyes are small with free orbital rims. The depth of body is 3.5–4 times in standard length. The mouth is small and oblique. The scales are moderate size and there are 40–43 scales on the lateral line. There is a single series of molar-like teeth, 5 on the right and 4 on the left. The short dorsal fin has 3 rays and 7 branched rays and is inserted above the pelvic fins. The pectorals are long and reach the pelvic fins. The caudal fin is deeply emarginate.

It feeds mostly on a snail lived in small streams, pools and lakes, sometimes takes crustaceans.

It is said that the black carp does not breed in ponds. It spawns in the Yang-tze, Han and west rivers of China and has not yet been observed to breed in any other locality.

In Japan, the eggs of present species were also introduced from China together with those of *Ctenopharyngodon idellus* (Cuvier et Valenciennes). Thereafter, they could not established in Japan.

10. **Gambusia affinis** Girard.

Top-minnow, "Kadayashi"

(Text-fig. 130)

Heterandria affinis B. et G. 1853, Proc. Acad. Nat. Sci. Phila., p. 390.

Gambusia affinis Girard, U. S. & Mex. Nound. Ichth., p. 72, pl. 39, figs. 12–15. – Günther, 1866, Cat. Fish., vol. vi, p. 336. – Jordan et Gilbert, 1882, Bull. U. S. Nat. Mus., no. 16, p. 346. – Ui, 1932, Kisyû Gyofu, p. 72. – Okada, et Nakamura, 1948, Nihon no Tansui Gyorui, pp. 144–145, fig. 63. – Kamohara, 1950, Descr. Fishes Tosa & Kishu, Japan, p. 62. – Aoyagi, 1957, Gen. Notes Freshwater Fish. Jap. Arch., pp. 68–69, figs. 54–55.

Description: Body moderately stout. Dorsal and anal fins similar in size and shape, the latter not much advanced. Coloration plain; dorsal and caudal dotted with black. Head 4; depth $3^4/_5$, D. 6; A. 8.

Type locality: Texas.

Height of body scarcely more than the length of the head; head $^1/_4$ of the total body length. Origin of the dorsal fin a little nearer to the extremity of the snout than to that of the caudal fin. Anal fin similar to dorsal in size and in shape, its origin being but little in advance of that of the dorsal. Ventrals slender, extending considerable further backwards than the pectoral. Dorsal and caudal more or less dotted with black.

Distribution: Florida, North America; River Missippi; Texas; Mexico; West Indies; Cuba; Hawai; Formosa; Ryûkyû; Ishigaki Isl.; Iriomote Isl., Miyako Isl., Okinawa Hontô; Irabu Isl.; Iye Isl.; Hikone, Shiga Prefecture; Wakayama City, Wakayama Prefecture; Susaki, Kôchi Prefecture.

Remarks: This fish was introduced from Formosa into Japan for the extermination of *Malaria* disease. They are breeding in the streams near Senju, Tôkyô City. They like to catch the *Anopheles* and other mosquito larvae, floating in the water of pools and tanks.

UI* mentioned that the fish were introduced into Wakayama Prefecture and made the breeding by help of Wakayama Fisheries Experiment Station for the extinction of *Malaria* mosquito larva but not attained a good result of breeding as they propagate in summer and most of them die in winter by lower water temperature.

The breeding season may continue from the middle of March to the middle of October, the most prosperous season prpbably from May to September. When the water temperature raised 20°C. or more, the delivery may begin and 30°C. water temperature the best.

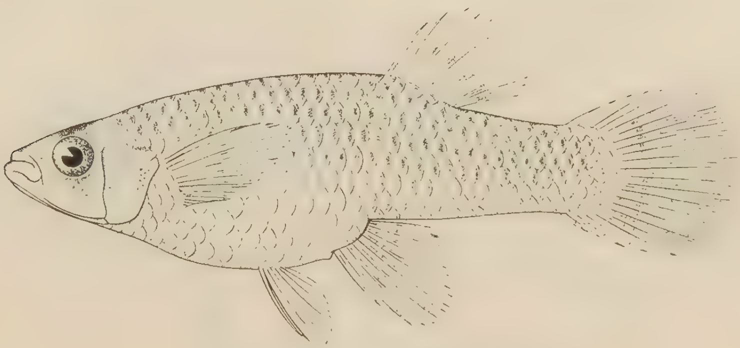
In 1911, IGAI one of the authorities of the Formosan Government has brought 600 individuals from Hawai Island, during transportation from Hawai to Yokohama, 436 individuals were died and 38 individuals also died during the voyage of Yokahama and Formosa. At last 126 individuals were alive in Formosa. After that time, the Formosan Government has made constant efforts of culture and distributed about 40 million individuals over the whole regions of Formosa. 200 individuals of these were introduced from Formosa into Nara Prefecture by a goldfish dealer and those of offsprings were distributing over Shiga and Wakayama Prefectures.

The *Gambusia* are inhabitants of the southern United States, Central America and the West Indies. Real *Gambusia affinis* is a native of the San Antonio-Guadalupe River systems in Texas and has never been available to the aquarist. It is native to Alabama, Mississippi, Illinois, and through Texas to Tampico in Mexico.

This species resembles *bolbrookii* in type, size and habits, but its anal fin is smaller and

*UI, 1932, Kishû Gyofu, p. 72.

a number of tiny spots cover the sides and vertical fins. Both sexes have plain fishgray bodies with metallic blue reflections. The dorsal and anal fins have dark markings. The male attains a length of about one and a half inches, the female about two and a half to three inches.



Text-fig. 130. ***Gambusia affinis*** GIRARD.

It is prolific breeders, as, indeed, they need to be, because the adults make short work of their young of given the chance.

The present species is a justly famed fish, for it has saved many human lives by eating mosquito larvae. It has been introduced into many parts of the world for this purpose, but its chief service to man has been in destroying the larvae of the mosquito which carries the germs of malarial and yellow fevers. In tropical countries in situations where the draining of mosquito ditches is impossible or too expensive, the little fish has been successfully brought into service. Its practical value is enhanced because it can live in good or bad water, and will stand a temperature range from 40–100 degrees.

In the vicinity of Tôkyô, it is found in the ditches, marshes and ponds. 200 adults have been introduced previously from Formosa into Kôriyama, Nara Prefecture by SHUNRIN KOMATSU, goldfish dealer during 1916. They have been brought into several districts of Japan proper. It has been introduced into many places of Japan proper for the purpose of destroying malarial mosquitoes, also into the far northern part of Honshû, Tôkyô where now is abundant generally ponds and irrigation ditches in there. During the war, we used it for killing of the malarian mosquito larva (*Anopheles sinensis*) together with *Oryzias latipes* in Tôkyô.

They bring forth their young alive, breeding when from three to five months old, and though they thrive in cool or brakish waters, spawn only in warm, freshwater. Twenty to fifth yellowish fry are numbered in each batch, and broods may be produced at intervals of from four to 10 weeks in a water temperature of from 75° to 80°. The fry, which are expelled in masses of eight to 30, are 37 on an inch long at birth and can swim immedlately.

On July 25, 1918, top-minnows were introduced from Kôriyama.

Key to the species of Macropodus

a[1]. Anal with 10-12 rays. The posterior half of the lower margin of praeorbital covered by the skin of infraorbital. The praeorbital triangular and weakly serrated. The caudal rounded. .... **M. chinensis**

a[2]. Anal with 11-15 rays. The posterior half of the lower margin of praeorbital quite free. The praeorbital quadrangular. with one serration. The caudal slightly forked. ... **M. opercularis**

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2). KOBAYASHI, H. 1625: Delivery of *Gambusia affinis* (I-II). Top-minnow *Gambusia affinis* no Bunben ni tsuite. Suisan Kenkyushi, Vol. 20, No. 6; Vol. 21, No. 7.

11. Macropodus chinensis (BLOCH).

(Text-fig. 131)

Chaetodon chinensis BLOCH, 1790, Ausl. Fische, IV, p. 5, pl. CCXVIII, fig, 1.

Macropodus chinensis, MYERS, 1926, Copeia, no. 150, p. 99. - OKADA, UCHIDA, MATSUBARA, 1935, Nihon Gyorui Zusetsu, p. 180, pi. 93, fig. 1. - NICHOLS, 1943, Freshwater Fish. China, pp. 241-242. - OKADA et NAKAMURA, 1948, Nihon Tansuigyorui, pp. 102-103, fig. 123. - AOYAGI, 1957, Gen. Notes Freshwater Fish. Jap. Arch., pp. 194-195, fig. 163.

Macropodus opercularis, NICHOLS, 1928, Bull. Amer. Mus. Nat. Hist., LVIII, p. 50.

Pseudosphromenus opercularis, CHU, 1931, Biol. Bull. St. John's Univ., Shanghai, no. 1, p. 103.

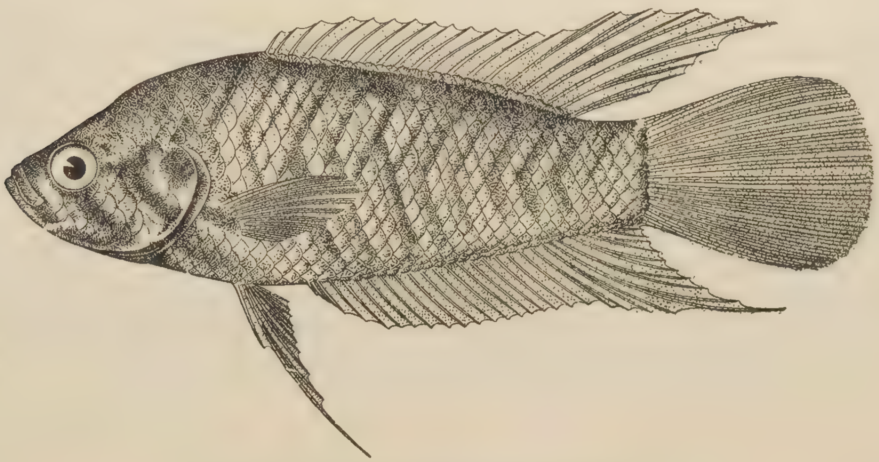
Description: Depth in length to base of caudal, 2.5 to 2.7; head, 2·9; eye in head, 4 to 4.5. Dorsal rays, XIV-XVII, 7 to 8; anal, XVIII-XX, 10 to 12; scales, 26-31.

Body oblong, compressed. Head rather large, pointed; interorbital flat, slightly greater than eye diameter. Mouth small, superior; maxillary reaching to below anterior nostril; jaws with small villiform teeth; nostrils separated, the anterior one close to the lip, the posterior above the anterior margin of eye. Opercle smooth; lower edge of pre-opercle finely serrated. Gill-membranes united across isthmus and free from it.

Scales ctenoid, covering body and head; 28 scales in a lateral scales, 12 scales in a transverse series between the origin of dorsal and anal, 6 scales between orbit and end of opercle. A scaly sheath at the base of anal and at the posteriior half of the base of dorsal.

Dorsal with 17-18 spines and 6-8 soft rays, the spines increasing in length posteriorly, the middle soft rays greatly produced. Anal similar to dorsal, with 20-22 spines and 9-12 soft rays, the spines are loger posteriorly, the middle soft rays also greatly produced, the last soft ray is connected to the caudal by a membrane. Origin of dorsal and anal oppositte to each other, or that of the former slightly behind. Ventral with 1 spine and 5 soft rays, the lst soft ray greatly produced. Pectoral pointed at tip, with 10 soft eays, extending below to 7th or 8th spine of dorsal.

Color in fresh is brown and greenish brown, with 10 or more transverse blue bands; a prominent green spot on the end of opercle; a dark oblique streak running from eye to the end of opercle reddish, with blue spots, pectoral plain, light brown.



Text-fig. 131. ***Macropodus chinensis*** (Bloch).

Distribution: Southern China; Korea (Okada & Matsubara); Formosa; Ryûkyû (Okada & Nakamura); Tôkyô; Niigata; Nagoya; Yamagata; Okayama (appeared from 1914, introduced from Formosa); Nagai Machi; Yamagata Prefecture (Hashimoto); River Shinano, Niigata Prefecture (Aoyhgi); Kasumigaura; Tsuchiura, Ibaraki Prefecture (Takatsuka); Nasu, Tochi Prefecture; Yedo River, River Ara (Aoyagi); River Tsurumi; River Rokugô, Kanagawa Prefecture (Oshima); River Kiso (Niwa); Takaoka Chô, Kochi Prefecture (Kamohara).

Remarks: Two species *M. chinensis* and *M. opercularis* were introduced into Japan. The former species was very common in small ponds, diches, and swamps and collected for enjoyment while the latter species was founded in limited area of Kochi Prefecture in Shikoku and of Okinoerabu Island of Kagoshima Prefecture. The very common *Macropodus* have been gradually decreased and nearly disappeared in 1946. Now very few in numbers in Japan.

According to Y. Matsui, *Macropodus sinensis* (Bloch), was introduced from Seoul of Korea by Eizo Iida during 1914 into a gold-fish pond belong to Kichigoro Akiyama, at Fukagawa-ku, Tôkyô. In the spring of 1916, it propagated in there. On the 30th of September, they were carried away by a disastrous flood into River Ayase. In 1922, they were spread into Minami-Katsushika-gun of Tôkyô City and into Saitama Prefecture as well as into Lake Kasumigaura of Ibaraki Prefecture. They were also gradually extended into Saitama, Chiba, Ibaraki Prefectures and Tôkyô. In the vicinity of Kasumigaura Lake, they were used for food fish. In the northeastern part of Honshû, they

were caught at Kashiwazaki, Niigata Prefecture during 1925* and also found in Yoroigata in 1932*. During 1946 they were distributed in Niigata City. In Yamagata Prefecture, they were found only in Nagai-mura, Okitama-gun during 1936–1938 years. This indicates the northern boundary of this distribution (38°15 in northern latitude) in Japan.

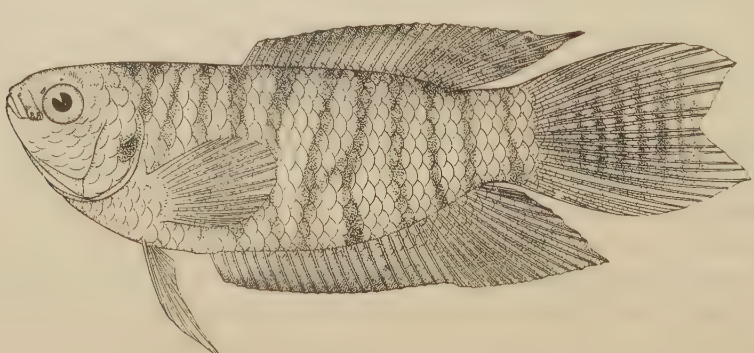
In the south-western districts, they were found in Nagoya and Atsuta Cities of Aichi Prefecture and in 1946 found in Kuwana City of Mie Prefecture. In the vicinity of Okayama, they were discharged in rivers for the indirect prevention of Katayama disease (*Schistomias* disease). If it was certain, the southern limit of distribution of the present species shows 34°36′ of latitude.

The second species *Macropodus opercularis* (LINN.) has a very limited distribution. They were introduced from China into a pond located in the northern part of Takaoka-cho, Takayama-gun, Kochi Prefecture during 1897. They were fixed in natural condition.**

The were also introduced into Okinoerabu Island, one of the Amami Ôshima group, Kagoshima Prefecture during 1937 and now in good conditon.

12. Macropodus opercularis (LINNAEUS).
(Text-fig. 132)

Macropodus opercularis CANTOR, 1842, Ann. Mag. Nat. Hist., IX, p. 484. – REGAN, 1909, Proc. Zool. Soc. London, p. 774. – WEBER et BEAUFORT, 1922, Fish. Indo Austr. Arch., IV, pp. 341–347. – JORDAN et HUBBS, 1929, Mem. Carn. Mus., vol. X, no. 2, p. 207. – KIMURA, 1934, Fishes Yangtze Kiang, China, pp. 190–192. – AOYAGI, 1957, Gen. Notes Fresh. Wat. Fish. Jap. Arch., pp. 192–194, figs. 162. – HARADA, 1943, Hiananto Tansui Gyoruifu, p. 74, pl. XXI, fig. 85.
Labrus opercularis LINN., 1788, Amoen. Academ. IV, p. 428. – BLOCH, 1801, System. ichthyol, p 245.
Macropodus venustrus CUV. et VALENCIENNES, 1831, Hist. Nat. Poiss., VII, p. 357.
Macropodus ocellatus CANTOR, 1842, Ann. Mag. Nat. Hist., IX, p. 484.



Text-fig. 132. ***Macropodus opercularis*** (LINNAEUS).

*MINAGAWA HIROSHI, 1932.
**NAKAMURA, MASAO reported in 1939.

Polyacanthus opercularis RICHARDSON, 1845, Ichth. China, Report British Associat., 1846, p. 250. - MAX WEBER, 1894, Zool. Ergebn. Reise Nied. Ost. Indien, III, p. 418. - GÜNTHER, 1859, Cat. Brit. Mus., III, p. 379.

Pseudosphromenus opercularis BLEEKER, 1879, Verh. Akad. Amsterdam, XVIII, Poiss. Chine, p. 2.

Description: D. XIII–XIV, 8–9; A. XVII–XX, 11–12; P. 11; V. 15; L. 1. 28 (31)–30 (33); L. tr. 13–14.

Height 2.7 to nearly 3, head 3 or somewhat more in length. Rostro-dorsal profile declivous, somewhat concave on head. Eye 3.2–3.5 in length of head, 1.5 to 1.7 in its postorbital part and less than flat interorbital space, which goes 2.6 to 2.8 inhead. Snout much shorter than eye. Maxillary reaching vertical through space between nostrils. Praeorbital serrated. Origin of dorsal about opposite to that of anal, which has small scales in addition to basal sheath of 2 series of larger scales. Soft dorsal and anal pointed or strongly produced, in which case the otherwise pointed caudal is bilobed. Pectorals slightly shorter than head without snout. A round black spot, bordered with white, on extremity of operculum; light brown with dark cross-bars.

Distribution: Okinawa (JORDAN & HUBBS); Soo-chow. China (CORA B. REEVES); Highlands of Padang, Sumatra; West Java; China; Cochin China, Formosa ; Loo Choo Islands (WEBER & BEAUFORT); Okinawa Hontô (SAKAGUCHI, JORDAN, TANAKA, OKADA, AOYAGI); Okinoerabu; Kumejima (OGAWA).

Key to the species of Ophicephalus

a[1] Scales arranged from the insertion of dorsal fin to the lateral line 4–6; scales on lateral line 56–58; dorsal rays. 40–44; anal rays. 26–29. .... **Oph. maculatus**

a[2] Scales arranged from the insertion of dorsal fin to the lateral line 7–10; scales on lateral line 59–69; dorsal rays 45–53; anal rays 31–35. .... **Oph. argus**

Reference

1). WATANABE,M. : Notes on fighting fishes of Macropodidae found in Honshû. Botany and Zoology, Vol. 2, No. 4, pp. 671–690. (in Japanese).

2). ————, 1946: On *Macropodus chinensis* (BLOCH) and its allied species, Shigenkagaku Kenkyûsho Iho, No. 9,1946. (in Japanese).

13. Ophicephalus argus (CANTOR).

(Text-fig. 133)

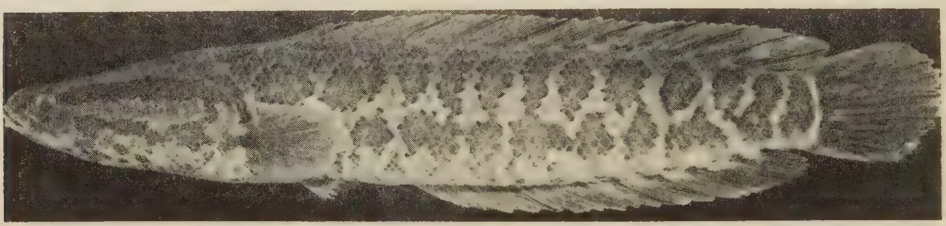
Ophicephalus argus CANTOR, 1842, Ann. Mag. Nat, Hist., IX, p. 484. - CHU, 1932, Fishes West Lake, pp. 48–50, pl. 34. - NICHOLS, 1943, Freshwater Fishes China, p. 238.

Ophicephalus pekinensis BASILEWSKI, 1855, Nouv. Mem. Soc. Nat. Moscou, X, p. 225, pl. IX, fig. 3.

Channa argus OKADA et MATSUBARA, 1938, Nihon san Gyorui Kensaku, p. 143, - NAKAMURA, M. 1939, Suisan Kenkyushi, 34 (1), pp. 333–337, fig 1. - OKADA et NAKAMURA, Nihon Tansuigyo, p. 192, fig. 122. - MATSUBARA, 1955, Fish Morph. & Hier., pt. 1, pp. 503–504.

Description: Depth in length to base of caudal, 5.6; head, 3.1; eye in head, 8. Dorsal rays; 49 to 52; anal, 32 to 33; scales, 62 to 67.

Body elongate, subcylindrical anteriorly, compressed posteriorly; tail almost as long as head and trunk. Head depressed in front, elevated behind; interorbital flat; eye small, situated above the middle of the upper jaw; nostrils separated, the anterior in a short tube and close to the upper lip, the posterior above anterior margin of eye. Mouth large, reaching far behind eye; lower jaw projecting. Narrow bands of small teeth, some enlarged canine-form teeth along sides of mandible and palatines. Gill-membranes united across isthmus and free from it; gill-rakers low, tubercular, beset with fine teeth.



Text-fig. 133. ***Ophicephalus argus*** (CANTOR).

Scales cycloid, covering body, tip and sides of head; 66–67 scales in the lateral line to caudal base, 8 above lateral line to dorsal origin, 12 or 13 below to anal origin. Lateral line continuous, running along median axis of tail from caudal base to above vent, thence upward for 2 scales, extending forward to above gill opening. A series of pits along edge of preopercle to the chin, another along preorbital, 3 pits behind eye, 3 from above eye to tip of snout, a transverse series of 4 pits behind the interorbital, and oblique series of 3 above opercle.

Dorsal very long, with 49–50 rays, the posterior ones longer. Anal similar to dorsal but shorter, with 31–32 rays. Ventrals small, not reaching vent, with 1 simple and 5 branched rays; origin opposite to the 4th rays of dorsal. Pectorals rounded at tips, extending to beyond base of ventrals. Caudal rounded.

Color blackish with a yellowish wash; numerous blackish blotches arranged in longitudinal rows of small blotches on back, 2 rows of big blotches on each side; numerous irregular spots on ventral surface of head and abdomen. Head blackish, with 2 conspinuous black band extending back from eye to gill-cover. Pectorals and ventrals yellowish; other fins blackish. Length of body up to 250 mm.

Habits: UCHIDA, K.[1] noted the life history of *Channa argus* cultured in Korea, as follows. "It is known to be distributed in southern Siberia, Manchuria, Korea (except in its northeastern district) and in northern China southward to the River Yan-tse. The usual habitats of the fish are the shallow ponds or swamps of rather stagnant water and muddy bottom, richly grown with water-plants. It is found also in the slow streams,

1). UCHIDA, K. 1933, Bull. Fish. Exp. Stat. Chosen, no. 3, series C, no 1, pp. 89–90.

but is never in the clear running water. Air-breathing habit is well developed, accompained by the corresponding structure of the supra-branchial chamber as is already well known, causing almost entire indifference to the faulness of water in which it lives. From the experiments carried out by the authors, it has been known that the air-respiration is absolutely necessary for this fish, except in the hibernation period when the

Table 134. Measurements of *Ophicephalus argus* (CANTOR).*

Total length	Body length	Body height	Head length	Eye diameter	Snout length
420mm.	358mm.	60mm.	108mm.	10mm.	19mm,
455.0	390.0	62.0	110.0	10.5	20.0
460.0	400.0	62.5	120.0	11.0	20.5
470.0	403.0	64.0	123.0	11.0	20.5
475.0	410.0	66.0	124.0	11.5	20.5
495.0	430.0	73.0	124.0	11.0	21.0
510.0	440.0	74.0	126.0	11.5	22.0
540.0	460.0	76.0	136.0	11.5	22.0
560.0	475.0	78.0	146.0	12.0	22.0
570.0	495.0	83.0	145.0	12.0	25.0
660.0	580.0	90.0	164.0	13.0	26.0
670.0	580.0	93.0	164.0	13.5	26.0

*These measurements were made by K. UCHIDA, K. for the specimens collected in Korea.

Table 135. Measurements of *Ophicephalus argus* (CANTOR)**

Locality	Total length	Body length	Body length / Body height	Numb. scales on lateral line	Dorsal fin ray	Anal fin ray
Notauchiko, Shiga Pref.	37.5mm.	32.7mm,	5.67	63	49	34
Yawata, Shiga Pref.	31.0	26.6	5.32	64	51	34
Koriyama, Nara Pref.	33.5	28.5	5.00	60	45	31
——	12.0	10.1	5.61	62	46	31
——	11.2	9.4	5.88	61	49	32
——	25.0	21.2	6.42	62	49	32
Yashumachi, Shiga Pref.	34.0	30.0	6.00	67	51	34
——	27.0	23.0	6.39	63	50	33
——	20.5	18.5	6.61	63	49	33
Tomochigata, Ishikawa Pref.	51.5	45.0	6.0	66	51	35

**These measured specimens were obtained at many locations, and introduced from Korea in the end of Meiji Era into Ōsaka. NAKAMURA, N. measured these specimens in 1939.

respiratory function almost ceases. It suffocates in a relatively short time if it is forcibly kept under water so as to prevent completely the air respiration, no matter how freely the water so as to prevent completely the air respiration, no matter how freely the water in which the fish is kept, is changed. Whereas it can live ever quite healthy in any faul water in which no other fish can live of the free air-respiration is admitted. It can live also entirely out of water quite a long white, the duration of which depending upon the air temperature; about 24 hours at 25°–27°C.; 3–4 days at 10°–15°; a week at the average temperature of 7°C.; about 3–4 days at the average of 1°, often lowering below 0°C. That is, the maintenance of life out of water is shorter in higher temperature, becomes longer as it lowers, but becomes shorter again below certain limit.

Its natural food consists of various small aquatic animals, such as small fish, frogs,

water-insects, etc., which or voraciously feeds upon. The spawning season is from June to July, sometimes extending to early August. Before spawning the pair of parent fish build a nest among the water plants in shallow water. The nest is made out of stems and fronds of weeds in a shape of irregular circle of about one meter in diameter, floating at the surface of water. The water surface in the nest where the eggs are spawned is cleaned. The spawning usually takes place at dawn or early in the morning of a calm day. At first the female rises up to the water surface and keeping her belly upward discharges eggs, followed by the male which taking similar attitude ejaculates the sperm, thus accomplishing the fertilization. The number ef eggs spawned at one time is 1,300–15,000, average 7,300. The number of spawning during one season by the same female fish is, by the author's observations, 1–5. The egg is floating and non-adhesive, spherical, about 2 mm. in diameter, with a single very large oil-globule, and beautiful yellow in color. It hatches out quite healthy at any water temperature between 18°–31°C. The incubation period lasts about 28 hours at 31°C, 120 hours at 18°, and about 45 hours at the ordinary water temperature during spawning season, i. e. about 25°C.

The larva just hatched is about 4 mm. in total length. The body is almost black all over during the whole larval stage, and looks like a young tadpole in general appearance. It floats in the nest, feebly moving about it times, until the end of the larval stage when the yolk is completely absorbed and the body length attains about 8 mm. Then it swims out of the nest in a shoal to feed upon minute organisms in the water.

When the post larval stage has set in, the black coloration of the body begins to fade, at first in the dorsal side and later downward. The air-respiration also begins in this stage. At the end of the post-larval stage, when the body length becomes about 18 mm., a beautiful greenish yellow coloration prevails over the body, leaving only a dark streak along the base of the anal fin. From its stage on the fish greedily feeds upon small crustaceans, fish-larvae or any other small animals which come across, causing very rapid growth. The parent fish eagerly guard over their brood till the end of the post-larval stage, boldy driving away any enemy, such as frog, eel or other animals, which will likely attack them.

At the stage of about 30 mm. in total length the fish attains the general aspect similar to an adult in shape, coloration and in habit. It becomes mature in two years when the total length reaches about 300 mm. The size of the adult fish commonly met with in Korea is 350–450 mm. in total length, being 2–4 years of age. The largest specimen examined by the authors in 850 mm. in total length and supposed to be over 20 years old".

Distribution: Siberia, Manchuria; Korea; River Yantse, China. In Japan, it was introduced from Korea during 1923 and 1924 into a reservoir located Kôriyama-machi, Nara Prefecture and now dispersing in Ishikawa Prefecture, Shiga Prefecture and Kantô district of Honshû.

Ophicephalus group: At present, the Ophicephalidae found in Japan includes two spe-

cies *Channa argus* (CANTOR) and *Ch. maculatus* (LACEPEDE). The introducing process of these fishes is yet uncertain. But it is said that these fishes were brought from Korea in 106 by private culturists, and later from Formosa in 1916. *Channa argus* (CANTOR) called "Kamulti" in Japanese were brought by a gentleman who lived in Minami-Kôriyama, Kôriyama-machi, Nara Prefecture, from Korea during (1923–1924). He has tried it to culture in a reservoir and now apparently propagated. They are now spreading in many rivers and lakes of Honshû. At first they spreaded into River Tomio, south of Kita-Kôriyama, Ikoma-gun, Nara Prefecture. Another group found in the river basin of Yashû-gun, Shiga Prefecture, was introduced from Kôriyama, Nara Prefecture by a freshwater fish dealer in ("Shôwa" 8 y ear, 1933) and discharged them in a reservoir. One other group located in Hagui-gun and Kashima-gun of Ishikawa Prefecture, was introduced from Nara district in 1933. The most large and strong group spreading over River Tone of Kantô district has no on inquiry into the origin of introducing. Generally, the present species give the damages for fishes existed before, after the introducing. Many fish feeders and the conservation of tributary fishes make great alarm for this harmful fishes. So a few people use this fish as food. It shows a wrong example resulted from careless importation of a new fish into Japanese waters. *Ch. maculatus* called "Raihii" or "Taiwan Dozyô" in Japanese, was identified by a scientific name by *Ophicephalus tadianus* JORDAN et EVERMANN. This is southern form and native in Formosa. According to K. UCHIDA, one of his friend of TSUJI, KIHARA at Toyonaka, Ôsaka-fu has brought five youngs measured about 200 mm. from Formosa to his pond located at Ikeda-machi, Ôsaka-fu. When a flood was experienced, they were carried away to a rivlet. At present, they were spreading in Hônô-gun, Mishima-gun, Kitakawachi-gun and Senhoku-gun of Ôsaka district. The one group is now distributing in pond and ditches of Susoo-mura in the vicinity of Sakai City. In 1906, KOMATSU KINREISHA, one of the gold fish culturist at Kôriyama, Nara Prefecture has exhibited it as a very rare fish from South sea, in an aquarium held by the 5th exhibition. The other group found in Kyôto district, has been reported at Ogura-Ike (a pond) and River Katsura basin even in 1933. In Hyôgo Prefecture, they are spreading in the rivers far east of Himeji, along the Seto inland sea side during 1924–1925. They have been introduced from Ôsaka-district by a freshwater fish dealer.

14. Ophicephalus maculatus (LACEPEDE).

Bostrychus maculatus LACÈPÉDE 1802, Hist. Nat. Poissons, III, pp. 140, 143.

Ophicephalus guentheri SAUVAGE et DABRY de THIERSANT, 1874, Ann. Sci. Nat., Paris, Zool., (6) 1 (5) p. 4.

Ophicephalus lucius KOLLER, 1927, Ann. Naturhist. Mus. Wien, ILX, p. 41, pl. 1, fig. 7.

Ophicephalus tadianus, JORDAN et EVERMANN, 1902, Proc. U. S. N. Mus., 25, p. 1289. – MIYADI, 1935, Kyôtofu Tansuigyo, pp. 38-40, pl. 2, pl. 5, fig. 39.

Ophicephalus maculatus GÜNTHER, 1861, – HARADA, 1943, Hainantô Tansuigyofu, p. 73, pl. LXXIII,

figs. 91, 92. – NICHOLS, 1943. Freshwater Fishes China, p, 238, fig. 127, pl. x, fig. 2.
Channa maculata OKADA et MATSUBARA, 1938, Nihon san Gyorui Kensaku, p. 143. – NAKAMURA, 1939, Suisan Kenkyûshi, 34 (1), pp, 333–337, figs. 2, 3.
Chnna tadiana OKADA, et MATSUBARA, 1938, Nihon san Gyorui Kensaku, p. 143. – AOYAGI, 1957, Gen, Notes Freshwater Fish. Jap. Arch., pp. 190-192, fig. 161.

Description: Depth in length to base of caudal, 5.1; head, 2.7; eye in head, 6.6. Dorsal rays, 1+4 to 46; anal. 28 to 30; scales, 55 or 56.

Body spindle shaped, compressed posteriorly, caudal peduncle short, greatly compressed; head long and snake-like, covered with plate-like scales; eye small; nostrils wide apart, the anterior in a small tube on upper edge of maxillary; mouth oblique, large; a band of small teeth on outer edge of jaws; upper jaw protractile.

Dorsal long, of numerous spine-like rays; low anteriorly, gradually lengthening posteriorly; caudal rounded; anal similar to dorsal, but not so long; ventrals very small and short, not reaching vent; pectoral short and rounded; lateral line not continuous, running along center of body from base of caudal to just over second anal ray, thence upward for 2 rows of scales, then forward for 15 rows of scales, thence downward for 1 row, then forward to upper edge of gill-opening, where it ends.

In alcohol specimens, it is olivaceous-brown above, lighter below; below white, with some yellowish markings; a row of 12 dark olivaceous blotches along base of dorsal, partly on fin and partly on body; below these but above lateral line another row of 8 or 9 similar but larger blotches, extending anteriorly to the middle of upward curve in lateral line; below this another line of about 13 lighter colored and very irregular blotches, extending from base of pectoral posteriorly along lower edge of lateral line to base of caudal; below this another line of scattered and faint blotches from lower edge of pectoral to posterior end of anal; head color of upper part of body, but streaked with irregular lines of black above; a line of light dusky, as wide as pupil, but becoming nearly as broad as eye at edge of opercle, running from posterior edge of eye to base of pectoral, its lower edge just below upper base of pectoral; below this an irregular line of light brown-olivaceous slightly wider than pupil, running to middle of base of pectoral; head below this pale; dorsal arch 2 broken stripes of brown-olivaceous about as wide as pupil; caudal membranes dark, rays pale brown-olivaceous, anal with indications of 4 or 5 dark blotches at the base of posterior half, rest of fin pale at base, becoming darker, almost brown-olivaceous toward tips; ventrals pale, dusky; pectoral slightly darker than ventrals.

Distribution: South China; Hainan Island; Formosa.

Remarks: In Japan, it was introduced from Formosa into Ikeda-machi, Osaka by M. KIHARA during 1916, the specimen was exhibited in the Sakai Aquarium attached to the fifth Naikoku Kangyô Exhibition held at Sakai City. That specimen was introduced from Formosa into Koriyama Gold fish pond established by Komatsukinreisya company. It is now spreading into Nara and Hyôgo Prefectures in Japan. River Ka-

nzaki, Osaka; Sakai City, Osaka (UCHIDA & FUJIMOTO); Lake Biwa; River Yodo; Hiroshima Prefecture; Kasumigaura; River Tone; River Ara; River Furutone; River Shinano (AOYAGI); River Tenjin, Kumozu; Mie Prefecture Aota, Tsu (KUBOTA).

The another groups which found in Kôriyama-machi, Nara Prefecture during (1930) and in Higashi Asai-gun, Shiga Prefecture in Showa 8. Two case are quite uncertain about the introducing process.

The present fish has a very strong resistance for different enviroments. It has a large mouth with strong teeth, the lower jaw projecting more anterioly than the upper jaw. A broad super branchial cavity located in the branchial cavity, the inner wall is provided with a few respiratory ridges covered by a mucous membrane and functioned as a respiratory organs. It has a strong resistance for the lack of oxygen in waters and also can support the life out of water, even in wet air condition so long time.

By the experiments, it can live seven days in 7° air temperature out of water.

It lives in shallow waters, located by a lot of water plants of rivers and ponds. In the beginning of summer, it makes a nest by water weeds and spawns. Youngs are protected by parents. Eggs are lighter, floating on the water surface. It catches frogs and young fishes, exhibiting a kind of harmful fish for fish-culture. The growth very rapid, attain to 33 cm. body length in River Yodo, Ôsaka.

Reference

1). MIYADI. D., Freshwater fishes in Kyôto districts. Kyoto-fh Shiseki Miesho Tennen Kinenq-utsu Chôsa-hôkoku, Vol. 16, pp. 1–46, pls. 1–5. (in Japanese).

2). ________., Opphicehalidae fishes found in Japan proper. Suisan Kenkyûshi, Vol. 34, No. 12, pp. 333–339. (in Japanese).

15. Micropterus salmoides (LACÈPÉDE).

It is said that two species of the black bass were introduced from the United States America into Japan in 1941. One was introduced by the Faculty of Agriculture of Tôkyô University from America to Ashinoko, Hakone, Kanagawa Prefecture during May of 1925. It was consisted 75 individuals measured about 6–9 cm. and 3 individuals of 45 cm. in body length.

The other was introduced from United States America by T. AKABOSHI in about 1930. He has brought 3 adult fishes and 70 youngs which were discharged into his pond near the summer residence of Japanese Emperor at Hakone and some of them run away into Ashinoko Lake.

Two forms just mentioned above are quite uncertain the scientific name. One of these seems to be *Micropterus salmoides*. They are distributing in Ashino-ko, Hakone, Kanagawa Prefecture. The seasonal migration is carried out in the lake, in winter they move to deep water and in the end of April (water temperature 12°C) they begin to

move to shallow water. When the water temperature raises to 24.5°C., they come to shallow water of 20 fms into a lot of water plants with sandy pebbled base in midday and move to shallower water in night to feed.

During October when the water temperature goes down below of 15°C. they begin to move into somewhat deep water. At the beginning of December they disappeared along the coast of lake and come to deeper water. The breeding season may continue about one month during June when the water temperature becomes 17.8°C. They make a spawning elliptical ground of 30–40 cm. in diameter and 6–9.5 cm. deep located in somewhat lighter pebbled bottom with small group of water weeds, 1.5–2 m. deep.

It is afraid that black bass may harmful for "Himemasu" in this lake. During the whole year, both species are inhabiting in a quite different layer of waters, only intermingled together in a shallow water during the spring and autumn when the water temperature ranging nearly 12°C. The stomach has never content of "Himemasu", only of 22% of *Hypomesus olidus* which is very rich fishing in this lake, amount of 3432 kg. in a year. From this data, the black bass seems not harm to all kinds of fishes. A very few have propagated in freshwaters other than Lake Ashinoko, in Mt. Hakone.

Reference

1). HATA, KYUZO & TAKEDA, KAZUO, 1943: Black bass found in Ashino-Ko (Ashionko san Black bass ni tsuite). Suisangakuzasshi, No. 48, pp. 65–71.

3. Annoted List of Freshwater Fishes of Japan

(*introduced species)

Class. I. Cyclostomata

Order Petromyzonida

Fam. 1. Petromyzonidae

Genus *Entosphenus* GILL, 1863

1. *Entosphenus japonicus* (von MARTENS)
2. *Entosphenus tridentata* (GAIRDNER)

Genus *Lampetra* GRAY, 1851

3. *Lampetra reissneri* (DYBOWSKI)

Class. II. Osteichthys

Subclass Teleostomi

Superorder A. Chondrostei

Order Polyperida

Fam. 2. Acipenseridae

Genus *Acipenser* LINNAEUS, 1758

4. *Acipenser multiscutatus* TANAKA
5. *Acipenser acutirostris* AYRES
6. *Acipenser kikuchii* JORDAN et SNYDER

Superorder Teleostei

Order Clupeida

Suborder Elopina

Fam. 3. Elopidae LACÉPÈDE, 1803

Genus *Megalops*

7. *Megalops cyprinoides* (BROUSSONET)

Fam. 4. Elopidae

Genus *Elops* LINNAEUS, 1766

8. *Elops saurus* LINNAEUS

Suborder Clupeina

Superfamily Clupeicae

Fam. 5. Clupeidae

Genus *Clupea* LINNAEUS, 1758

9. *Clupea pallasii* VALENCIENNES

Fam. 6. Engraulidae

Genus *Coilia* GRAY, 1831

10. *Coilia mystus* (LINNAEUS)
11. *Coilia ectenes* JORDAN et SEALE

Suborder Salmonina

Fam. 7. Salmonidae

Genus *Oncorhynchus* Suckley, 1861

12. *Oncorhynchus nerka* (Walbaum)
13. *Oncorhynchus gorbuscha* (Walbaum)
14. *Oncorhynchus tschawytscha* (Walbaum)
15. *Oncorhynchus keta* (Walbaum)
16. *Oncorhynchus kisutch* (Walbaum)
17. *Oncorhynchus masou* Brevoort
18. *Oncorhynchus rhodurus* Jordan et McGregor

Genus *Salmo* Linnaeus, 1758

*19. *Salmo gairdnerii irideus* Gibbons

Genus *Hucho* Gunther, 1866

20. *Hucho perryi* Brevoort

Genus *Salvelinus* Richardson, 1836

21. *Salvelinus malma* (Walbaum)
22. *Salvelinus pluvius* (Hilgendorf)
23. *Salvelinus leucomaenis* (Pallas)
24. *Salvelinus imbricus* Jordan et McGregor
*25. *Salvelinus fontinalis* (Mitchill)

Fam. 8. Plecoglossidae

Genus *Plecoglossus* Temminck et Schlegel, 1846

26. *Plecoglossus altivelis* Temminck et Schlegel

Fam. 9. Osmeridae

Genus *Osmerus* Lacépède 1758

27. *Osmerus dentex* Steindachner

Genus *Hypomesus* Gill, 1862

28. *Hypomesus olidus* (Pallas)
29. *Hypomesus japonicus* (Brevoort)

Genus *Spirinchus* Jordan et Evermann, 1896

30. *Spirinchus lanceolatus* (Hikida)

Fam. 10. Salangidae

Subfamily Protosalanginae

Genus *Salangichthys* Bleeker, 1860

31. *Salangichthys microdon* Bleeker
32. *Salangichthys ishikawae* Wakiya et Takahashi

Subfamily Salanginae

Genus *Salanx* Cuvier, 1849

33. *Salanx ariakensis* Kishinouye
34. *Salanx cuvieri* Cuvier et Valenciennes

Genus *Neosalanx* Wakiya et Takahashi, 1937

35. *Neosalanx reganius* Wakiya et Takahashi

Order Cyprinina

Suborder Cyprinina

Fam. 11. Cyprinidae

Subfamily Cyprininae

Genus *Acheilognathus* Bleeker, 1860

36. *Acheilognathus longipinnis* Regan
37. *Acheilognathus rhombeus* (Temminck et Schlegel)
38. *Acheilognathus moriokae* Jordan et Thompson
39. *Acheilognathus tabira* Jordan et Thompson
40. *Acheilognathus lanceolatus* (Temminck et Schlegel)
41. *Acheilognathus limbatus* (Temminck et Schlegel)
42. *Acheilognathus cyanostigma* Jordan et Fowler

Genus *Tanakia* Jordan et Thompson, 1914

43. *Tanakia orizae* (Jordan et Seale)
44. *Tanakia tanago* Tanaka

Genus *Rhodeus* Agassiz, 1835

45. *Rhodeus ocellatus ocellatus* (Kner)

Genus *Acanthorhodeus* Bleeker, 1870

46. *Acanthorhodeus atremius* Jordan et Thompson
47. *Acanthorhodeus sciosemus* Jordan et Thompson

Genus *Pseudoperilampus* Bleeker, 1863

48. *Pseudoperilampus typus* Bleeker

Genus *Pungtungia* Herzenstein, 1892

49. *Pungtungia hilgendorfi* (Ishikawa)
50. *Pungtungia shirai* Oshima

Genus *Sarcocheilichthys* Bleeker, 1860

51. *Sarcocheilichthys variegatus* (Temminck et Schlegel)

Genus *Abbottina* Jordan et Fowler, 1903

52. *Abbottina rivularis* (Basilewsky)

Genus *Gnathopogon* Bleeker, 1860

53. *Gnathopogon elongatus elongatus* (Temminck et Schlegel)
54. *Gnathopogon elongatus caerulescens* (Sauvage)

55. *Gnathopogon japonicus* (SAUVAGE)
56. *Gnathopogon biwae* (JORDAN et SNYDER)
57. *Gnathopogon gracilis* (TEMMINCK et SCHLEGEL)

Genus *Pseudogobio* BLEEKER, 1863

58. *Pseudogobio esocinus* (TEMMINCK et SCHLEGEL)

Genus *Hemibarbus* BLEEKER, 1861

59. *Hemibarbus barbus* (TEMMINCK et SCHLEGEL)
60. *Hemibarbus longirostris* (REGAN)

Genus *Biwia* JORDAN et FOWLER, 1903

61. *Biwia zezera* (ISHIKAWA)

Genus *Pseudorasbora* BLEEKER, 1860

62. *Pseudorasbora parva parva* (TEMMINCK et SCHLEGEL)
63. *Pseudorasbora parva pumila* MIYADI
64. *Pseudorasbora parva uchidai* OKADA et KUBOTA

Genus *Aphyocypris* GUNTHER, 1868

65. *Aphyocypris chinensis* GUNTHER

Genus *Tribolodon* SAUVAGE, 1883

66. *Tribolodon hakuensis hakuensis* (GUNTHER)
67. *Tribolodon hakuensis phalacrocorax* (JORDAN et SNYDER)
68. *Tribolodon jusanensis* (JORDAN et HUBBS)
69. *Tribolodon hakuensis ezoe* OKADA et IKEDA
70. *Tribolodon taczanowskii* (STEINDACHNER)

Genus *Moroco* JORDAN et HUBBS, 1925

71. *Moroco stenidachneri* (SAUVAGE)
72. *Moroco jouyi* (JORDAN et SNYDER)
73. *Moroco percnurus percnurus* (PALLAS)

Genus *Zaccco* JORDAN et EVERMANN, 1902

74. *Zacco platypus* (TEMMINCK et SCHLEGEL)
75. *Zacco temmincki* (TEMMINCK et SCHLEGEL)

Genus *Opsariichthys* BLEEKER, 1865

76. *Opsariichthys uncirostris* (TEMMINCK et SCHLEGEL)

Genus *Mylopharyngodon* PETERS, 1880

*77. *Mylopharyngodon piceus* (RICHARDSON)

Genus *Ctenopharyngodon* STEINDACHNER, 1866

*78. *Ctenopharyngodon idellus* (CUVIER et VALENCIENNES)

Genus *Hemigrammocypris* FOWLER, 1910

79. *Hemigrammocypris rasborella* FOWLER

Genus *Ishikauia* JORDAN et SNYDER, 1900

80. *Ishikauia steenackeri* (SAUVAGE)

Genus *Cyprinus* LINNAEUS, 1758

81. *Cyprinus carpio* (LINNEAEUS)

Genus *Carassius* NILSSON, 1832

82. *Carassius auratus* (LINNAEUS)
83. *Carassius auratus cuvieri* TEMMINCK et SCHLEGEL
84. *Carassius auratus langsdorfii* CUVIER et VALENCIENNES

Genus *Hypophthalmichthys* BLEEKER, 1860

*85. *Hypophthalmichthys moritrix* (CUVIER et VALENCIENNES)
*86. *Hypophthalmichthys nobilis* (RICHARDSON)

Subfamily Cobitidae

Genus *Misgurnus* LACEPEDE, 1803

87. *Misgurnus fossilis anguillicaudatus* (CANTOR)

Genus *Barbatula* LINCK, 1790

88. *Barbatula toni toni* DYBOWSKI

Genus *Lefua* HERZENSTEIN, 1888

89. *Lefua echigonia* (JORDAN et RICHARDSON)
90. *Lefua nikkonis* JORDAN et FOWLER

Genus *Hymenophysa* McCLLELAND, 1838

91. *Hymenophysa curta* (TEMMINCK et SCHLEGEL)

Genus *Cobitis* ARTEDI, 1738

92. *Cobitis biwae* (JORDAN et SNYDER)
93. *Cobitis taenia striata* IKEDA
94. *Cobitis taenia matsubarae* OKADA et IKEDA
95. *Cobitis delicata* NIWA

Suborder Silurina

Fam. 12. Siluridae

Genus *Parasilurus* BLEEKER, 1863

96. *Parasilurus asotus* LINNAEUS

Fam. 13. Bagridae

Genus *Pseudobagrus* BLEEKER, 1858

97. *Pseudobagrus aurantiacus* (TEMMINCK et SCHLEGEL)

Genus *Coreobagrus* MORI,

98. *Coreobagrus ichikawai* OKADA et KUBOTA

Genus *Pelteobagrus* BLEEKER, 1865

99. *Pelteobagrus nudiceps* (SAUVAGE)

Genus *Liobagrus* HILGENDORF, 1878

100. *Liobagrus reini* HILGENDORF

Order Apodes

Suborder Anguillina

Fam. 14. Anguillidae

Genus *Anguilla* Shaw, 1804

101. *Anguilla japonica* Schlegel

102. *Anguilla marmorata* Quoy et Gain Uran

Order Cyprinodontida

Suborder Cyprinodontina

Fam. 15. Cyprinodontidae

Genus *Oryzias* Jordan et Snyder, 1906

103. *Oryzias latipes* (Temminck et Schlegel)

Fam. 16. Poeciliidae

Genus *Gambusia* Poey, 1854

*104. *Gambusia affinis* (Baird et Girard)

Suborder Exocoetina

Fam. 17. Hemiramphidae

Genus *Hemiramphus* Cuvier, 1817

105. *Hemiramphus sajori* Temminck et Schlegel

106. *Hemiramphus kurumeus* (Jordan et Snyder)

Suborder Gasterosteida

Fam. 18. Gasterosteidae

Genus *Gasterosteus* Linnaeus, 1758

107. *Gasterosteus aculeatus aculeatus* (Linnaeus)

108. *Gaserasteus aculeatus microcephauls* (Girard)

Genus *Pungitius* Coste, 1846

109. *Pungitius pungitius pungitius* (Linnaeus)

110. *Pungitius pungitius tymensis* (Nikolsky)

111. *Pungitius pungitius sinensis* (Guichenot)

112. *Pungitius pungitius kaibarae* Tanaka

Order Percida

Suborder Mugilina

Fam. 19. Mugilidae

Genus *Mugil* Linneaeus, 1758

113. *Mugil cephalus* Linnaeus

Suborder Channina

Fam. 20. Ophicephalidae

Genus *Ophicephalus*, Bloch, 1794

114. *Ophicephalus argus* (Cantor)

115. *Ophicephalus maculatus* (Lacèpéde)

Suborder Anabantina

Fam. 21. Anabantidae

Genus *Macropodus* LACÈPÉDE, 1802

116. *Macropodus chinensis* (BLOCH)
117. *Macropodus opercularis* (LINNAEUS)

Suborder Percina

Fam. 22. Kuhlidae

Genus *Kuhlia* GILL, 1861

118. *Kuhlia marginata* (CUVIER et VALENCIENNES)

Fam. 23. Serranidae

Subfamily Macullochellinae

Genus *Lateolabrax* BLEEKER, 1857

119. *Lateolabrax japonicus* (CUVIER et VALENCIENNES)

Subfamily Polypriominae

Genus *Coreoperca* HERZENSTEIN, 1896

120. *Coreoperca kawamebari* (TEMMINCK et SCHLEGEL)

Fam. 24. Theraponidae

Genus *Therapon* CUVIER, 1817

121. *Therapon oxyrhynchus* TEMMINCK et SCHLEGEL

Fam. 25. Centrarchiidae

Genus *Micropterus* LACÉPÈDE, 1802

*122. *Micropterus salmoides* (LACÉPÈDE)

Suborder Gobiina

Fam. 26. Eleotridae

Genus *Eleotris* GRONOW, 1763

123. *Eleotris oxycephalus* TEMMINCK et SCHLEGEL

Genus *Mogurnda* GILL, 1863

124. *Mogurnda obscura* TEMMINCK et SCHLEGEL

Fam. 27. Gobiidae

Subfamily Tridentigerinae

Genus *Tridentiger* GILL, 1858

125. *Tridentiger obscurus* (TEMMINCK et SCHLEGEL)

Subfamily Gobiinae

Genus *Rhinogobius* GILL, 1859

126. *Rhinogobius similis* (GILL)
127. *Rhinogobius giurinus* (RUTTER)

Genus *Acanthogobius* GILL, 1859

128. *Acanthogobius lactipes* (HILGENDORF).
129. *Acanthogobius flavimanus* TEMMINCK et SCHLEGEL
130. *Acanthogobius hasta* (TEMMINCK et SCHLEGEL)

Genus *Awaous* CUVIER et VALENCIENNES, 1837

131. *Awaous ocellaris* (BROUSSONNETT)

Genus *Chaenogobius* GILL, 1862

132. *Chaenogobius annularis annularis* (GILL)
133. *Chaenogobius annularis urotaenia* (HILGENDORF)
134. *Chaenogobius castanea* (O' SHAUGHNESSY)
135. *Chaenogobius isaza* TANAKA

Genus *Leucopsarion* HILGENDORF, 1880

136. *Leucopsarion petersi* HILGENDORF

Genus *Luciogobius* GILL, 1859

137. *Luciogobius guttatus guttatus* GILL

Subfamily Sicydiaphiinae

Genus *Sicydium* CUVIER et VALENCIENNES, 1829

138. *Sicydium japonicus* TANAKA

Order Cottida

Suborder Cottina

Fam. 28. Cottidae

Subfamily Cottinae

Genus *Trachidermus* HECKEL, 1840

139. *Trachidermus fasciatus* HECKEL

Genus *Cottus* LINNEAEUS, 1758

140. *Cottus pollux* GUENTHER
141. *Cottus kazika* JORDAN et STARKS
142. *Cottus japonicus* OKADA
143. *Cottus hangiongensis* MORI
144. *Cottus reini* HILGENDORF

Order Pleuronectida

Suborder Pleuronectina

Fam. 29. Pleuronectidae

Subfamily Pleuronectinae

Genus *Platichthys* GIRARD, 1854

145. *Platichthys stellatus* (PALLAS)

Genus *Kareius* JORDAN et SNYDER, 1900

146. *Kareius bicolaratus* (BASILEWSKY)

Order Symbranchida

Suborder Symbranchida

Fam. 32. Flutidae

Genus *Fluta* BLOCH et SCHNEIDER, 1801

147. *Fluta alba* (ZUIEW)

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(alphabetical arrangement).

Akita-ken Suisan Shikenjo Shiken Jigyo Hokokusho ········· Report of the Fisheries Experiment Station, Akita Prefecture.

Ann. Zool. Jap. ············ Annotationes Zoologicae Japonenses, published by the Zoological Society of Japan, at Zoological Institute, Tôkyô University.

Bot. & Zool. ············ Botany and Zoology published by Yôkendô Co. Ltd., Tôkyô.

Bull. Aichi Gakugei Univ. ········· Bulletin of Aichi Gakugei University, Okazaki, Aichi Prefecture.

Bull. Biogeo. Soc. Jap. ············ Bulletin of Biogeographical Society of Japan.

Bull. Fac. Fish. Nagasaki Univ. ············ Bulletin of the Faculty of Fisheries of Nagasaki University.

Bull. Fac. Lib. Arts. Ibaraki Univ. ············ Bulletin of the Faculty of Literature and Arts, Ibaraki University, Utsunomiya, Ibaraki Prefecture.

Bull. Fresh. Fish. Lab. ············ Bulletin of the Freshwater Fisheries Laboratory attached to the Bureau of Fisheries of Ministry of Agriculture and Forestry, Tôkyô.

Bull. Jap. Soc. Sci. Fish. ············ Bulletin of the Japanese Society of Science Fisheries.

Bull. Mar. Biol. Stat. Asamushi, Tohoku Univ. ·········· Bulletin of the Marine Biological Station Asamushi, Aomori Prefecture.

Collecting and Breeding ········ Monthly Magazine of Collecting and Breeding published by Uchida Rokakuho Co. Ltd. Tôkyô.

Cyaologia ··········· Cytologia published by the Cytological Society of Japan, Tôkyô.

Dainihon Suisan-kaiho ············ Periodical Magazine published by Dainihon Suisankai.

Dobutsu Bungaku ············ Magazine of Animals concerned with Literature, Tôkyô.

Ecological Review. ············ Ecological Review published by Mt. Hakkôda Botanical Laboratory, Aomori Prefecture.

Embryologia ··········· "Embryologia" published by the Zoological Institute, Faculty of Science, Nagoya University.

Fauna Musashiensis ········ Special Report of the Fauna of Musashi District around Tokyô Musashi High School, published by the Musashi High School.

Folia Anat. Jap. ············ Folia Anatomica Japan, published by the Anatomical Department of Keiô Medical University, Tôkyô.

Gyogaku Zasshi ············ Ichthyological Magazine, published by Dr. SH. TANAKA, Tôkyô.

Hakubutsugaku Zasshi ············ Natural History Magazine, published by the Society of Natural History, attached to the Tôkyô Normal High School, Tokyô.

Hokkaido Teikoku Daigaku Rigakubu Dobutsugaku Kyoshitsu Daiichikoza Kenkyu Shoho ······ Miscellaneous Report of the Zoological Instiute of Faculty of Science, Hokkaidô Imperial University.

Hokusetsu Sangaku Horaijisan Kenritsukoen Ittai no Shigenkagaku Hokoku ············ Report of the Natural History Research around Mt. Horaiji Prefectural Park, Aichi Prefecture.

Hyogo Chuto Kyoiku Hakubutsugaku Zasshi ············ Magazine of the Natural History of Hyogo Middle School Education.

Jap. J. Ecol. ············ Japanese Journal of Ecology published by the Ecological Society of Japan.

J. J. G. ············ Japanese Journal of Genetics.

J. J. I. ············ Japanese Journal of Ichthyology, published by the Ichthyological Society of Japan, Tokyô.

J. J. L.········· The Japanese Journal of Limnology., published by the Lymnological Society of Japan.

Jap. Journ. Zool. ············ Japanese Journal of Zoology.

Journ. Coll. Scie. Imp. Univ. Tokyo ············ Journal of College of Science, of Tokyô Imperial University, Tokyô.

Jour. Fac. Sci. Hokkaido Imp. Univ. ············ Journal of the Faculty of Science, Hokkaidô Imperial University.

Jour. Fac. Sci. Niigata Univ.············ Journal of the Faculty of Science. Niigata University, Niigata Prefecture.

Journ. Facul. Sci.············ Journal of the Faculty of Science. Tôkyô Imperial University.

Jour. Imp. Fish. Inst. ············ Journal of the Imperial Fisheries Institution.

Jour. Sci. Hiroshima Univ. ············ Journal of Science, Hiroshima University.

Jour. Shimonoseki Coll. Fish. ············ Journal of the Shimonoseki College of Fisheries.

Jour. Tokyo Univ. Fish. ············ Journal of Tôkyô University, Fisheries Laboratory, Tokyô.

Kagaku ············Science published monthly by the Iwanami Co. Ltd., Tôkyô.

Kansai Shizenkagaku Kenkyukai Kaishi ············ Bulletin of the Kansai Natural History Society.

Keison Iho ············ Journal of Salmon and Trout published by the Hatching Laboratory, Hokkaidô.

Kumamoto Jour. Sci. ············ Kumamoto Journal of Science published by the Kumamoto University, Kumamoto, Kyûshû.

Kyoto-fuka Shiseki Meisho Tennenkinenbutsu Chosa Hokoku············ Report of the Natural Monuments of Kyôto and the Vicinity.

Kyoto Igaku Zasshi ············ Medical Magazine published by the Medical Society of Kyôto.

Coll. Sci. Kyoto Imp. Univ.······ Memoire of the College of Science, Kyôto Imperial University.

Mem. Hyogo Univ. Agric. ············ Memoires of the Hyôgô University of Agriculture, Tanba, Kyôto-fu.

Mikawa Shizen Koen Chosa Hokokusho············ Report of the Mikawa Natural Park published by the Aichi Prefecture Government.

Misc. Rep. Res. Inst. Natur. Resources ············ Miscellaneous Reports of the Research Institution for Natural Resources.

Nagaragawa no Seibutsu ············ Biology of the River Nagara, published by the Gifu Prefectural Government.

Nagoya Seibutsu Gakkai Kiroku ············ Bulletin of the Nagoya Biological Society.

Nara Ken Sogo Bunka Chosa Hokokusho ············ Report of the Investigation for the Civilization, Nara Prefecture.

Nogyo oyobi Engei ....Monthly Magazine of Agriclture and Horticulture, published by Yôkenndô Co. Ltd., Tôkyô.
Norinjiho .... Bulletin of Agriculture and Forestry published by the Bureau of Agriculture and Forestry.
Osaka Hakubutsugaku Zasshi ....Natural History Magazine of the Ôsaka Natural History Society.
Physiology and Ecology .... Journal of Physiology and Ecology, published by the Zoological Institute of Kyôto Imperial University.
Proc. Imp. Acad. .... Proceedings of the Imperial Academy.
Rep. Chichibu Nat. Hist. Mus. .... Report of Chichibu Natural History Museum.
Rep. Fac. Fish. Pref. Univ. Mie. .... Report of the Faculty of Fistheries Prefectural University of Mie.
Rept. Fifth Pac. Scie. Cong. .... Report of the Fifth Pacific Science Congress.
Rept. Gumma Fish. Stat. .... Report of the Gumma Fisheries Station.
Rep. Hokkaido Fish. Hatch. .... Report of Hokkaidô Fisheries Hatcheries.
Rigakukai .... Scientific Magazine published by Chukôkan, Tôkyô.
Sci. Bull. Fac. Agr. Kyushu Univ. ....Science Bulletin of Faculty of Agriculture, Kyûshû University.
Sci. Rep. Tohoku Univ. .... Science Report of Tôhoku University.
Sci. Rep. Tokyo Bunrika Daigaku .... Science Report of the Tôkyô University of Education.
Seibutsu .... Biology published by Hokusuisha Co. Ltd., Sapporo, Hokkaidô.
Shigen Kagaku Kenkyusho Daini Kenkyubu Gyoseki .... Report of the second Research Section of the Research Institute for Natural Resources.
Shinano Kyoiku .... Journal of Education, Nagano Prefecture.
Suisan Chosa Hokoku .... Report of Fisheries Investigation published by the Bureau of Fisheries.
Suisan Chosa Hokoku, Hokkaido .... Repot of the Hokkaidô Firheries Institution.
Suisan Gakkaiho .... Fisheries Bulletin published by the Fisheries Institute, Tokyô Imperial University, Tôkyô.
Suisangaku Syusei .... Memorial Monograph for. Prof. I. AMEMIYA,, published by Tôkyô Daigaku Shuppankai, Tôkyô.
Suisangaku Zasshi .... Fisheries Magazine published by the Fisheries Institute of Hakodate Fisheries College, Hokkaidô.
Suisan Ken-kyushi .... Suisan Ken-kyushi, a monthly Magazine for Fisheries.
Suisan Koshusho Hokoku. .... Report of the Fisheries Research Institute, Tôkyô.
Teisui .... Magazine of Fisheries published by the Society of Fisheries, Tôkyô.
Tohoku Journ. Agric. Resear. .... Tôhoku Journal of the Agriculture Research Institution.
Tokyo Gakugeizasshi .... Scientific Magazine of Asia, published by Shôkabô Co. Ltd., Tôkyô.
Tosano Hakubutsu .... Natural Hisrory Magazine of Tosa Province, Kôchi prefecture.
Toyama Kotogakko Hakubutsu Dokokaishi .... Toyama Natural History Magazine, published by the Natural History Society of Toyama High School, Toyama.
Trans. Sap. Nat. Hist. Soc. .... Transactions of Sapporo Natural History Society.
Tsuribito .... "Angler" Monthly Magazine, published by Tsuribito sha Co. Ltd., Tokyô.
Yamagata-ken Kyoiku .... Magazine of Education, Yamagata Prefecture.
Yoshokukaishi .... Bulletin of Pisciculture. published by the Pisciculture Society, attached to the Pisciculture Institute of Fisheries College, Tôkyo.
Zikken-keitai Gaku .... Journal of Experimental Zoology.
Zool. Mag. .... Zoological Magazine (Dobutsugaku Zasshi) published by Zoological Society of Japan, Zoological Institute, Tôkyô University.

5. Index

The following index contains scientific names of species and groups and vernacular names as well as names of fishing equipments. Names of class, sub-classes, orders, sub-orders, families are in capitals.

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